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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

Region 1

REPORTS
Region 1
Annual BRC
1960

1380 (3000)

WHITE PINE BLISTER RUST CONTROL

Calendar Year 1960

Division of State & Private Forestry

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Missoula, Montana
March 1, 1961

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This report was prepared under the direction of E. H. Juntunen, Chief, Division of State & Private Forestry from information furnished and by the National Forests, Intermountain Forest and Range Experiment Station, and National Park Service.

CONTENTS

WHITE PINE BLISTER RUST CONTROL - 1960

Forest Service

Region 1

Division of State & Private Forestry
Section of Insect and Disease Control

Page

I. Highlights of 1960, Region 1 Blister Rust Control Programs 1

- Overall Blister Rust Control Program 1
- Clearwater National Forest and Clearwater Timber Protective Association 5
- Coeur d'Alene National Forest. 7
- Kaniksu National Forest and Priest Lake Timber Protective Association 9
- Kootenai National Forest 11
- St. Joe National Forest and Potlatch Timber Protective Association 12
- National Parks Program 14

II. Statistical Tables 18

- Summary of all Programs. 20
- National Forest Program. 24
- State and Private Program. 30
- National Parks Program 35

III. Antibiotic Development and Improvement Work. 38

IV. Chemical and Ribes Ecology Development and Improvement 50

V. Microclimate Phases of Blister Rust Control. 51

VI. Development of Rust Resistant White Pine 53

VII. Scouting for White Pine Blister Rust 55

VIII. Mechanical Developments for White Pine Blister Rust Control. 58

IX. Appendix 59

Guidelines for Region 1 Blister Rust Control Program 59

Antibiotics Look Good in the Fight to Save Western White Pine from Blister Rust.

Antibiotic Treatment of Western White Pine Infected with Blister Rust (Reprint).

The Role of White Pine in Region 1.

I. HIGHLIGHTS OF 1960 REGION 1 BLISTER RUST CONTROL PROGRAMS

THE OVERALL BLISTER RUST CONTROL PROGRAM

By
H. J. Hartman, Head
Section of Forest Insect & Disease Control
H. J. Viche, in Charge
Blister Rust Control

This report covers the three control programs, National Forest, National Parks and State and Private, in Region 1. The Forest Service operating within the provisions of the Lea Act, conducts control operations to protect the white pine on national forest lands, and under cooperative agreements and/or Memorandum of Understanding with other agencies, provides leadership and technical direction for all control programs. Operational and project management services are performed by the region as requested by the cooperating agencies.

In Region 1, the administration of the white pine blister rust control program and the Methods Development & Improvement Unit in Spokane, Washington, is the responsibility of the Division of State & Private Forestry, Section of Forest Insect and Disease Control. The operation of the Northern Idaho Forest Genetics Center at Moscow, Idaho is a cooperative arrangement between the Intermountain Forest and Range Experiment Station at Ogden, Utah and the Divisions of State & Private Forestry and Timber Management. The Center is managed and directed by the Station.

The following agencies are conducting or actively cooperating in white pine blister rust control:

U. S. Forest Service
National Park Service
State of Idaho
Clearwater Timber Protective Association
Potlatch Timber Protective Association
Priest Lake Timber Protective Association
Bureau of Land Management
University of Idaho

Antibiotic Developments

Antibiotic developments resulted in the continued fundamental departure in blister rust control methods and policies. An important transition from blister rust control through ribes eradication to control by application of antibiotics is being made.

Preliminary results of aerial application of antibiotics by helicopter in June 1959 indicate that all blister rust infection was killed on about 80 percent of the trees. In these field tests both phytoactin and semicarbazone (a derivative of cycloheximide) showed good results. However, semicarbazone was phytotoxic; most 2- and 3-year old needles were cast on western white pine. When semicarbazone was applied in September, no phytotoxic action was evident.

During 1960 experimental antibiotic aerial spraying was conducted in May and September. Some 772 acres were sprayed by helicopter and 875 acres by fixed-wing plane.

One of the most remarkable facts regarding antibiotics in blister rust control is the very small amount of the basic antibiotic compound required to treat one acre. To treat the white pine stand on one acre by either the basal stem or aerial method requires only 7 to 8 grams or one-fourth ounce of the basic compound. Normally, 7 to 10 gallons of carrier are used for the 7 to 8 grams of compound. The small amount of antibiotic applied emphasizes the importance of proper formulating, mixing and application of the final spray solution. Any loss of the compound through crystallization, extraction and otherwise, must be avoided.

The exact period of blister rust infection immunity that will result from a single application of an antibiotic is not known. New infection has not been detected on any pines treated with antibiotics in the region. However, none of the last 5 years were highly favorable for pine infection.

Bioassay results show that a considerable amount of semicarbazone persisted in the upper and lower needles of pole size trees 16 months after aerial application. The semicarbazone was applied by helicopter at the rate of 200 ppm and 10 gallons of spray solution per acre.

Effective antibiotic formulations and application techniques have not yet been fully developed for killing blister rust infection on limber and whitebark pines.

Antibiotic Side Effects

No harmful side effects of any kind have been associated with the large-scale field application of antibiotics. This includes fish, wildlife, beneficial fungi and plant growth. Preliminary laboratory and field tests have been made for compounds being applied in the field. However, pines under 15 years of age can be injured by the Acti-dione stove oil solution unless application instructions are explicitly followed.

Control Method Transition

The ultimate regional objective is to do all blister rust control work through aerial and hand application of antibiotics. This transition will be made as rapidly as sound research and developmental results will permit. Present 1961 plans are to aerially spray 11,000 acres of advanced reproduction, pole and mature pine stands in May and June, and 20,000 acres in September and October at an average cost of $10.00 per acre.

Acti-dione Crystallization Problem

The large scale field use of No. 1 stove oil as a carrier for Acti-dione resulted in the use of stove oil from several different states and refineries. It was found that not all No. 1 stove oil holds Acti-dione in solution long enough for fully effective application. If the fuel oil being used is not compatible with Acti-dione, crystallization of the antibiotic may start in 20 minutes or more. This crystallization places the antibiotic in an unusable form and greatly reduces or destroys its effectiveness. For proper biological action, Acti-dione should remain in solution at least several days.

Antibiotic Mixing and Service Units Developed

Two 2,000-gallon military surplus semitrailer fuel tankers were converted to field units for mixing antibiotic formulations and for direct servicing of aircraft employed in aerial spray work. One 1,000-gallon water and one 1,000-gallon fuel oil tanker is required to supply each mixing tanker. These converted units provide for improved mixing of aerial spray solutions and a more economical means of loading aircraft.

Antibiotic Brochure Issued

In May 1960, Region 1 published a leaflet explaining the value, formulation and application of Acti-dione BR for the control of white pine blister rust. This brochure was designed to aid the small white pine woodland owners. The leaflet was given wide distribution and field reports now show that some landowners have treated their pine stands with this antibiotic. With these treated stands serving as demonstration areas plus a 25 percent reduction in cost of the antibiotic, it is hoped that use of the systemic toxicant will soon be generally accepted and applied by the woodland owners.

The Acti-dione Story Told in Several Publications

Articles on antibiotics prepared by the staff and papers coauthored with staff members of The Upjohn Company were published in Forest Science, Journal of Forestry, The Timberman and Western Forest and Conservation.

National Interest Shown

Several hundred members of forestry organizations, lumbermen, research personnel and some members of the Fifth World Forestry Congress viewed the antibiotic developmental work of Region 1 during 1960.

Control Accomplishments

During 1960 upward of 8,411,000 trees on 44,050 acres were treated with antibiotics requiring 21,230 man-days. Blister rust control crews eradicated ribes on 26,100 acres requiring 15,680 man-days.

Regional Guideline Established

Guidelines for establishing and conducting the regional blister rust control program were incorporated as a regional supplement in the Forest Service Manual. These guidelines reflect the change in control policy due to antibiotic developments.

Western White Pine Inventory Made

In 1960 an extensive stand inventory was made on the western white pine lands not included in the present blister rust control program. Lands of all ownership in northern Idaho and contiguous portions of Washington and Montana were covered. Survey results showed that there are approximately 1,535,000 additional acres sufficiently stocked to western white pine that could and should be be brought through to commercial maturity by application of antibiotics. Thus, of the original 3,600,000 acres of western white pine type in the Inland Empire, 2,498,000 acres remain salvable from blister rust through previous ribes eradication work and now antibiotics. Initial antibiotic treatment must be accomplished by 1970. Additional financing will be required for this expanded program.

Spread of the Rust

No new infection locations were found in 1960 outside the known southern and southeastern limits of the rust, although considerable local spread and intensification was found in most of the outlying infection centers previously reported. In general, 1960 appeared to be a medium to poor rust wave year.

Northern Idaho Forest Genetics Center

Effective August 21, 1960, all personnel, equipment, buildings and other facilities of the Northern Idaho Forest Genetics Center were transferred from the region to the Intermountain Forest & Range Experiment Station, Ogden, Utah. That portion of the rust resistant pine project that is developmental will be financed by the region.

A 17-acre experimental rust resistant pine seed orchard was established at Sandpoint, Idaho in 1960.

Blister Rust Control Personnel Retire

During 1960 Messrs. Clarence M. Chapman, Wayne F. Painter and Marvin C. Riley retired. Each of these career employees had upward of 30 years of blister rust control service. They contributed much to the advancement of blister rust control procedures.

Award Granted

Mr. Virgil D. Moss received a Departmental Superior Service Award for his highly significant contributions to forestry through pioneering the development and use of antifungal antibiotics to control white pine blister rust. Moss is the Research Forester in charge of the blister rust control Development and Improvement Project at Spokane, Washington.

Field Work Disrupted by Forest Fires

Some 7,836 man-days were lost to forest firefighting by Forest Service and state and private field crews. This loss is comparable to the 6,188 man-days lost to firefighting in 1959 and 7,900 man-days in 1958. However, blister rust control field work was disrupted more by fire calls in 1960 than in any of the past several seasons.

Ford Tri-Motor spraying a 40-year-old stand of western white pine with a solution of phytoactin. Coverage was 5 gallons per acre. St. Joe National Forest.

G-2 helicopter spraying a 25-year-old western white pine plantation with a solution of phytoactin. Now, infected trees such as in this stand, can be saved and carried through to a merchantable size. St. Joe National Forest.

CLEARWATER NATIONAL FOREST
and
CLEARWATER TIMBER PROTECTIVE ASSOCIATION

By
John Bushfield, Forester in Charge
Robert Graham, Forester

This was a remarkable year for blister rust control. It was a year of change, a year of readjustment to the wide-scale application of the antibiotic Acti-dione for the control of white pine blister rust. Some 3,740 man-days were spent in applying Acti-dione by the basal stem method as compared to 1,340 man-days spent in 1959.

Labor turnover, this season, was higher than normal with the greatest turnover in first-year men. A sufficient number of experienced men returned to form a good nucleus for each camp. Caliber of the men was comparable with the 1959 crews.

The Clearwater operation had six camps. Two 35-man camps, three 40-man camps, and one 60-man camp. The two 35-man camps worked on state and private units and the other four performed work on national forest units.

Ribes eradication was performed in Snake and Browns Creek units on state and private lands. Final eradication work was completed in Tamarack Creek unit and initial work was done in the Musselshell, Cedar Creek, Deception, Osier and Eldorado Creek units on national forest lands. Power spraying of stream-type ribes was also done in the Musselshell, Cedar, Deception and Eldorado Creek units. This work was done before establishment of the next white pine crop and in some areas will have to be followed up with one more working to eradicate ribes resprouts resulting from this season's spraying. Not all planned ribes eradication work was completed this season because of fire activities but will be scheduled for completion the first part of the 1961 season. This will include work in the Canal Gulch, Browns Creek and Upper Orofino Creek units.

Antibiotic work was continued in Hildebrand and Reeds Creek units on state and private lands, and Sylvan Creek and Powder House units on national forest lands. Antibiotic application was started in Deer Creek and Jaype of the state and private units and Musselshell and Deadwood units of the national forest program. Antibiotic work was completed in the Independence unit and the remainder of the Sylvan Creek plantation.

A stocking and damage survey was completed by three 2-man crews on pole stands in Musselshell, Gold, Dewey, Lolo, Chamook, Nevada, Cedar and Brady Creek on national forest units and Snake Creek on the state and private units. This survey was made to determine the need for and to establish the priority of antibiotic treatment for the areas.

A cataloguing survey of all white pine type within national forest and association boundaries was completed in 1960. This was done to determine what white pine stands presently not in the control program, could be brought to maturity through the application of antibiotics and without any ribes eradication.

During the summar a talk on the blister rust methods and objectives was given to a group of school teachers attending a conservation workshop sponsored by Potlatch Forests, Incorporated. Approximately 30 teachers were in attendance. A tour was made of an area treated with Acti-dione after a briefing on blister rust and methods of its control. A question and answer period followed in which considerable interest was shown in antibiotics and its potential in the field of forestry.

No ribes contracting was done on the Clearwater this season. The program was discussed in the orientation of employees, but no one was interested enough to inquire further.

Portable 5 kw. light plants were obtained on surplus the fall of 1959. These were used in the field camps to advantage during the field season.

Two 1,500-gallon steel tanks with stands and one 3,000-gallon fabric pillow tank were also obtained on surplus for fuel oil storage in camps using antibiotics. In addition, a 4,000-gallon semitrailer was obtained through surplus channels. This trailer was set in place at the warehouse for use as a central oil storage tank. Delivery was made to the field with a 1,000-gallon tank mounted on the project 6x6 truck.

Power sprayers were again used to advantage to pump the antibiotic solution into inaccessible areas in the field to eliminate back-packing. Three camps used sprayers in this manner.

Approximately 40 man-days were spent in control burning operations. Sixteen hundred acres were burned within six white pine management units. Conditions for burning were near ideal with a negligible amount of acreage lost because of wild fire.

More than 2,000 man-days were lost to fire suppression activities this season. This is the most time lost from project work in more than a decade. The fire load came in the middle of the field season and as a result an abnormally high loss of personnel occurred by the first of August. August is usually the most productive month, from the project standpoint, because crews are well seasoned and have settled into an efficient work routine.

The 1961 program will be continued with an anticipated expansion in the use of antibiotics for aerial spraying as well as basal stem treatment. Objective for the 1961 field season is treatment of 12,000 acres of white pine with antibiotics.

Mr. M. C. Riley, Forester in charge, retired August 1, 1960, after more than 33 years in blister rust work. He was replaced by Mr. John Bushfield.

COEUR D'ALENE NATIONAL FOREST

By
Harry J. Faulkner, Forester in Charge
Andy O. Fossum, Forestry Aid (T.M.)

Seven camps were operated throughout the season. Two were located on the Fernan Ranger District at Hudlow Work Center and Deception Creek Experiment Station headquarters, and four on the Magee Ranger District at Trail Creek Work Center, Riley Creek, Jordan Creek and Potter Creek. A 16-man crew worked on the St. Regis District from the Savenac Nursery headquarters.

Effective man-days expended on field activities in 1960 decreased 20 percent from 1959. This reduction was due mainly to an expanded antibiotic program which required larger expenditures for Acti-dione and a heavier drain of manpower for fire suppression and control burning. Blister rust control crews spent 1,125 man-days on fire suppression exclusive of Saturdays and Sundays. An additional 400 man-days were used on control burns and fire training. Fire suppression and paid standby time on Saturdays and Sundays totaled an additional 1,130 man-days.

Spring and late fall weather conditions were generally favorable for field work. A week's rain in late August, when crews were at their peak efficiency, reduced accomplishments considerably for the season.

A good quality of seasonal overhead and workers were recruited. An anticipated increase in labor turnover, due to change from a 6- to 5-day workweek did not develop and labor turnover was unusually low. Decrease in worker earnings on the 5-day week on project work was offset by Saturday and Sunday fire suppression and standby throughout most of July and August.

Antibiotic treatment of infected white pine replaced ribes eradication as the major protection activity. Antibiotic work increased from 14 percent of the effective man-days in 1959 to 66 percent in 1960, exclusive of surveys.

Improved equipment for mixing, transporting, applying antibiotics, and improvement in organization and methods was largely responsible for an approximate one-third increase in acres treated per effective man-day.

The camps at Jordan Creek, Trail Creek, Deception Creek and Savenac Nursery worked exclusively on antibiotic treatment. Potter Creek and Riley Creek were predominately eradication camps but did some antibiotic work near the close of the season. A 15-man antibiotic crew began work at Hudlow in early May and worked throughout the season. An 11-man chemical ribes eradication crew worked the regular season.

A high percent of area treated was well stocked plantations of advanced reproduction and pole stands varying in age from 25 to 45 years. The Hudlow and Deception Creek camps worked primarily in natural reproduction and pole stands.

Checks and inspections of the 1958 and 1959 antibiotic treatment by the basal stem method indicated that generally very satisfactory results have been obtained. Results of early spring and late fall work during wet, cold weather appear less effective than work performed under favorable weather conditions.

In mid-September tests were made in the aerial application of antibiotics in 20- to 40-year old plantations in the Brett Creek and Independence Creek units.

Four hundred and eighty acres were sprayed by helicopter in the Brett Creek unit from heliports constructed on Packsack Ridge. Four hundred and sixty acres were sprayed on Independence Creek by fixed-wing plane operating from the Magee airstrip. Details of the study will appear in a separate report.

Ribes eradication was confined to protection of recently established white pine plantations on prescribed burn areas, recent cutover areas, and chemical eradication of ribes in advance of planting on prescribed burns.

Hand eradication was confined mainly to re-eradication on areas that were sprayed and planted in 1959 on Potter and Riley Creek prescribed burns.

Chemical ribes eradication was performed on Potter Creek and Flora Miller prescribed burns. Five truck-mounted power sprayers were used. Working conditions on the 300 acres sprayed on the Flora Miller Hill were difficult due to heavy brush cover and numerous old, residual ribes.

Extensive surveys to determine rust damage and white pine stocking were run on 596,600 acres. The purpose of these extensive surveys were to obtain an inventory of potentially commercial white pine stands supporting sufficient pine values to warrant the cost of hand or aerial antibiotic treatment. Surveys were run on potential pine areas both inside and outside national forest boundaries regardless of ownership. Major emphasis was placed on pine areas outside present management units where no recent information on rust spread and damage was available.

Intensive disease and stocking surveys were run on 3,000 acres in present white pine management units to determine priority of areas for antibiotic treatment.

Information and education work was carried on throughout the year to acquaint private timber landowners and the general public with the use of antibiotics in the control of white pine blister rust. Media used were newspaper articles, handout material, window displays during Forest Festival Week, talks and demonstrations given at logger's show, Farm Forester's Clinic, Junior High School Forestry Conference and show-me trips for 4-H groups, County Commissioners, and individuals.

White pine was planted on 180 acres in the Potter Creek prescribed burn area in 1960 for a total of 740 acres of white pine plantations now in the unit. Two hundred and seventy-five acres were prescribed burned in white pine management units during fall of 1960.

Ronald Stickney who had been in charge of checking and surveys the past 2 years was transferred to the Kingston District as assistant ranger. He was replaced by Junior Forester John Jenkins. Mr. Jenkins had 3 seasons' previous experience in blister rust control on the Coeur d'Alene National Forest.

G-2 helicopter equipped with spray boom and tanks. This type of helicopter can carry a load of 50 gallons of spray solution. Coeur d'Alene National Forest.

Loading helicopter with antibiotic solution from a 2,000-gallon mixing tank. Solution is pumped through 2-inch hose at the rate of 50 gallons in 40 seconds. Coeur d'Alene National Forest.

KANIKSU NATIONAL FOREST
and
PRIEST LAKE TIMBER PROTECTIVE ASSOCIATION

By
Quentin W. Larson, Project Officer
James R. Abbott, Forester

Blister rust control methods on national forest and state and private lands are changing rapidly from ribes eradication to direct treatment of western white pines with antibiotics. In 1960 during the month of June, 90 of the total force of 190 men were assigned to ribes eradication. Shortly after July 1, the entire program was directed to antibiotic treatment. Thirty of these men were employed within the Priest Lake Timber Protective Association.

Nine work camps were established with crews ranging from 10 to 30 men. Thirty-man camps were located at Pelke on the Upper West Branch, Boswell on the Lower West Branch, and one each at Kalispell Creek and North Fork of Lamb Creek. A 10-man camp was situated at Zero Creek, a previously dropped unit, where 350 acres of valuable white pine plantations and natural stands were treated. The two camps situated on Priest Lake Timber Protective Association lands were at Big Creek and Bear Creek with 20 and 10 men respectively.

Nearly one-third of all temporary employees this season were local men, living within a 90-mile radius of the forest headquarters. Sixteen forestry students were employed, seven of whom held overhead positions as camp superintendents, foremen or checkers.

A major portion of the ribes eradication work was performed on timber sale areas and financed with K-V funds. Pelke, Boswell and the North Fork of Lamb Creek camps accomplished all eradication work done by organized crews. Approximately 1,020 man-days were used to remove ribes from these areas where natural regeneration of western white pine is planned.

As a result of the shift to antibiotics, ribes eradication contracting decreased this year. A considerable amount of work was done however, on contracts carried over from 1959. Twenty-one new contracts were awarded in 1960 and eradication work was completed on approximately one-half of these.

No chemical eradication of ribes was performed in 1960, but spray work is planned in 1961 on recent burns and cutover areas where the ribes population is too heavy for hand eradication and the removal of ribes is essential for satisfactory white pine regeneration and protection.

The first nearly full-scale year of antibiotic treatment of white pine met with considerable success, despite much time loss to fire suppression. After the regular season was over, a 25-man crew of local personnel continued to work on antibiotic treatment until bad weather halted the program on November 10. The planned goal of 2,000,000 trees treated on 10,000 acres was exceeded.

White pine stands in and near campgrounds, picnic areas and administrative sites were treated with antibiotics in the Kaniksu and Colville National Forests. Antibiotics spray was also applied to white pine at the Priest Lake Timber Protective Association headquarters and at the State of Idaho Indian Creek campground on Priest Lake.

Five truck-mounted high-pressure sprayers were used this year to mix and distribute antibiotic solution to crews in the field. All pumpers formerly used for chemical ribes eradication work were employed in this task. A portable Bean-Cutler high-pressure pump with a 450-gallon tank mounted on a power wagon or a 1-ton stakeside truck was also used effectively. In some cases nearly a mile of hose was used to reach distribution stations in remote areas. Besides assuring a thorough and constant mixing of the solution, the pumps cut transportation time considerably and freed additional personnel to treat trees. The pump units were supplied with oil in the field by a 1,200-gallon oil tanker based at blister rust control Headquarters.

Fifty-five Dobbins pumps with special pack boards and mountings were purchased. Every effort was made to perfect the equipment and transport the solution directly to the crewman to increase production.

Weekly Acti-dione progress reports were prepared by each camp, combined at Headquarters and sent to all camps. This record was excellent in creating a healthy competitive spirit among the crews.

A large antibiotic aerial spray program is planned for the next few years on the Kaniksu and several heliports have been established. Special mixing and filling equipment will be available for this work.

An extensive survey program was undertaken to catalogue all areas of white pine outside present control units. Four to six men surveyed a total of 1,100,000 acres of Federal, State, private and BLM lands in Idaho, Montana and Washington. More intensive survey work will be done before the areas are treated.

The impact of the 1960 fire season was much greater than in past years. Over 43,000 man-hours were spent on fire suppression on the Kootenai, Nezperce, Bitterroot and Kaniksu. Approximately 2,350 man-days were lost to blister rust control which is more than 25 percent of the total man-days expended on field work.

The first rust-resistant white pine experimental seed orchard was established on the Kaniksu at Sandpoint in May 1960. Considerable work was performed by members of the Northern Idaho Forest Genetics Center and Kaniksu personnel in preparing the field and protecting the grafts. The orchard is located adjacent to a main highway and information signs have been erected. A fact sheet is also being prepared for distribution to tourists and other interested people.

During the summer, many show-me trips were conducted by blister rust control personnel for various groups of people including Mr. Richard E. McArdle, Chief, U. S. Forest Service. The trips included observation of antibiotic treated areas in Diamond, Kalispell Creek and Cuban Hill plantations.

Crewman spraying a western white pine tree with Acti-dione at a picnic ground near Binarch Creek, Kaniksu National Forest.

Pumper truck being filled with oil from a 1,200-gallon tanker in the field. Kaniksu National Forest.

KOOTENAI NATIONAL FOREST

By
Frank J. Kapel, Forester in Charge
Don Ingram, Forestry Aid (T.M.)

In 1960, the control of white pine blister rust was accomplished by the basal stem treatment of immature stands with antibiotics. No ribes eradication was done. Work efficiency and accomplishment was very good. This was primarily due to exceptionally good workers recruited. The percentage of returning experienced labor was less than in previous years, but sufficient key personnel did return to provide the overhead needed.

Antibiotic work started the first of May with a district crew of 8 men on the Yaak River Face adjacent to the Sylvanite Ranger Station. Beginning the first week in June this work was continued with a crew of 13 men. During the second week in June another crew of 13 men worked in the Hellroaring Creek drainage and a 70-acre stand in North Fork of Meadow Creek.

During the field season 450 man-days were spent on fire. Of this total 311 effective man-days, or 20 percent of man-days available during the field season, were lost to fire. Two hundred and seventy man-days, or 17 percent were lost to rain. Rainy day work consisted of release of white pine by removal of hemlock from a white pine stand in Fourth of July Creek, building of work trails, camp improvement and district work, such as brush disposal and cone collecting.

Intensive damage surveys were accomplished on 1,000 acres. Extensive surveys to catalogue potential white pine areas outside of presently approved blister rust units were done on 7,270 acres.

Plots were established in October to study the effectiveness of two different brands of fuel oil used as a carrier of Acti-dione. Acti-dione in concentrations of 150, 200, 250 ppm in fuel oil from a Montana and California source was used, both with and without Triton B-1956. We expect to get answers as to whether there are any differences as to compatability of Acti-dione with fuel oil from these two different sources.

The operation has completed the ninth consecutive year without a lost-time accident. This is a total of 214,000 man-hours since the last lost-time accident on July 5, 1951.

ST. JOE NATIONAL FOREST
and
POTLATCH TIMBER PROTECTIVE ASSOCIATION

By
Clyde J. Miller, Forester in Charge
Oliver Goldammer, Forest Technician

The St. Joe Forest insect and disease control organization administered the 1960 national forest and state and private blister rust control programs. The projects were directed by Staffman Clyde J. Miller. Wayne F. Painter and Harland Towne supervised the checking and disease survey work. The two unit supervisors were Albert E. Turner and Oliver K. Goldammer.

The antibiotic treatment of white pine stands was greatly increased in 1960. Acti-dione was applied by 150 crewmen to 10,690 acres of national forest; 2,230 acres of state; and 1,000 acres of private lands. The antibiotic work was concentrated on high-value 10- to 40-year-old white pine stands which were readily accessible for hand spray application. Spray work was performed in the following national forest units: West Fork Charlie (117B), Willow-Lower Emerald (128), Upper Emerald (131), West Fork St. Maries River (130), Purdue (180), Feather-Porcupine (179), Hog Meadows (164), and Bear-Corral (173-176). Work on state and private lands was done in the Moose Creek (177), Upper Elk (187A), and Bull Run (190A) units.

Antibiotic crews treated 130 acres of white pine stands outside of the national forest white pine management units in the Upper-Emerald Unit (131).

Additional outside areas near Elk River and in the Bussell-Marble drainage will be treated in 1961.

The spraymen used the Hudson 4-gallon pump (No. 291C) for applying Acti-dione. The Acti-dione was transported in 5-gallon jeep cans from the camp mixing station to the field distribution points. Where possible, 4-wheel drive vehicles were used to carry chemical over rough roads. Crewmen distributed spray solution by 5-gallon back-pack units.

Experimental applications of antibiotics from both a helicopter and fixed-wing plane were carried on during the last week in May. The helicopter was used to apply mixtures of phytoactin, semicarbazone, and methylhydrazone on 15 plots (250 acres) of 35-year-old white pine in the West St. Maries River Unit (130) near Clarkia. The fixed-wing plane sprayed phytoactin on five 80-acre plots in the Moose Creek Unit (177) near Bovill.

The ribes eradication program was reduced as planned on both national forests, and state and private units during 1960. Only 70 workers were assigned to ribes eradication work in 1960 compared to 180 in 1959. Ribes were removed in the following national forest control units: East Fork Charlie (117B), Willow-Lower Emerald (128), West Fork St. Maries River (130), and Purdue (180). Eradication work was also performed in three state and private units: Middle Fork St. Maries River (133), Flewsie (136), and Bloom Meadows (185). The eradication program was concentrated on removing ribes from recently logged areas and stream zones. Additional eradication work will be necessary on areas planned for natural regeneration of western white pine and areas prepared for planting to western white pine. Such stands will be protected from blister rust through ribes eradication until they reach the age when antibiotics will be used to bring the stand on through to maturity.

Two truck-mounted power sprayers were operated in the Bloom Meadow Unit (185). Twelve crewmen applied a 2,4,5,-T chemical mixture to 122 acres of cutover land supporting very heavy ribes concentrations. No chemical ribes eradication work is planned for the 1961 field season.

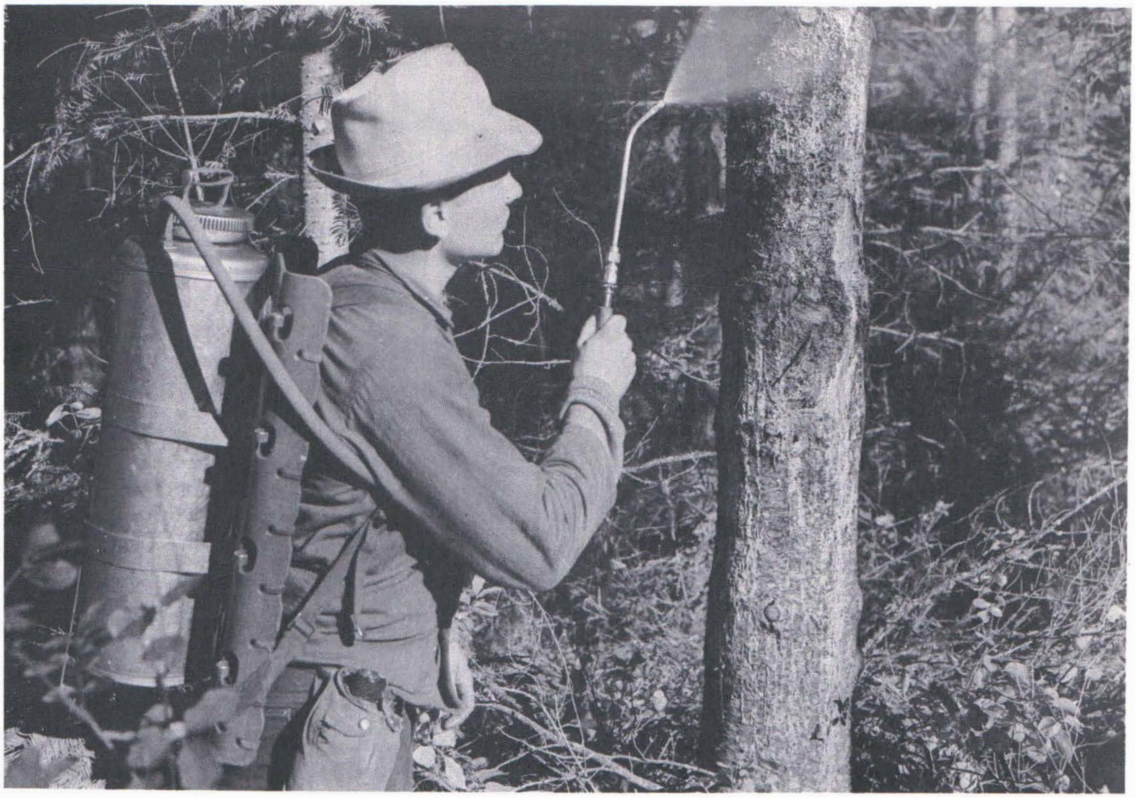
A 6-man crew surveyed 48,100 acres of white pine type to locate stands suitable for antibiotic treatment and to set up treatment priority schedules. Units examined outside of the present control program were in the Marble, Slate, and North Fork St. Joe River drainages. Antibiotic treatment is planned in all of these drainages during the next 2 years. An additional 40,000 acres were surveyed extensively.

Blister rust control crews were again called to suppress fires on several national forests during July. The time spent on fire control details by eradication and antibiotic treatment crews seriously hampered the planned seasonal program. Crews spent 3,055 man-days on fire suppression work and fire standby time. The loss of blister rust control effective time to the fire control activities amounted to 1,650 man-days.

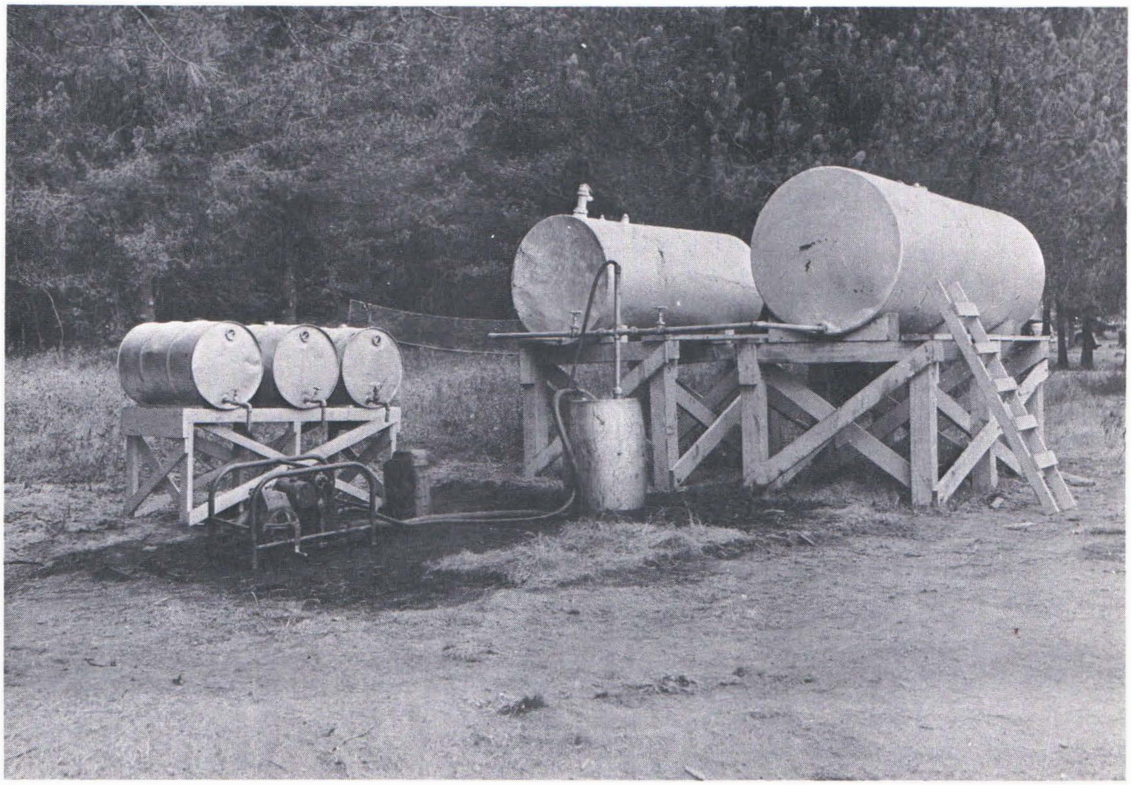
Considerable public interest was shown in the antibiotic spray program. Blister rust control officers conducted tours through various hand and aerial antibiotic development and demonstration plots with 14 different groups. Several of the larger parties were the Inland Empire Section of the Society of American Foresters, the Seventh Western International Forest Disease Work Conference, Inland Empire Disease Research Council, and the Northwest Pest Control Council from Portland, Oregon.

The annual Region 1, blister rust control field seminar was held at Clarkia from October 10 through 14. About 40 attended the meeting. Most of the discussion at the meeting was devoted to the review of antibiotic testing work and the problems of application on a project basis. Several field trips were taken to examine hand and aerial antibiotic test plots.

New blister rust control field office, kitchen, and housing facilities have been constructed at the Clarkia Ranger Station. A complete transfer of blister rust control personnel to the new quarters was made in September. Additional construction is planned to include equipment storage facilities and a general warehouse. The warehouses and equipment sheds at the old headquarters site are still being used for storage and equipment repair.



Crewman applying Acti-dione to a blister rust infected white pine that had previously been pruned. St. Joe National Forest.



Acti-dione mixing station at Tee Meadows Blister Rust Control Camp. St. Joe National Forest.

NATIONAL PARKS PROGRAM

By
John C. Gynn, Forester in Charge
Clarence M. Chapman, Forester

The National Park Service, Region II, White Pine Blister Rust Control Program was conducted as in previous years. By provisions of the Lea Act, and Memorandum of Understanding between the U. S. Departments of Agriculture and Interior, the Forest Service provides the National Parks Program, leadership, coordination, technical direction and some operational services when requested. National Park Service foresters are responsible for management and operational activities. All current and long-range plans are jointly prepared. This cooperative arrangement has functioned efficiently with no duplication of effort.

Personnel Participating

Glacier	C. Donald Barnum, Supervisory Park Ranger, in Charge
Yellowstone	W. S. Chapman, District Ranger, in Charge Marion W. Myers, Forester in Charge John N. Reeves, Forestry Aid, Unit Supervisor
National Park Service, Region II	Maynard B. Barrows, Forester
U. S. Forest Service, Region 1	John C. Gynn, Forester, in Charge Clarence M. Chapman, Forester

Objectives

The 1960 working plans were designed to complete initial ribes eradication on the Two Medicine Lake area in Glacier National Park and all initial ribes eradication work in Yellowstone National Park. Rework and maintenance control activities were based on previous checking and survey results. The plan included continuing antibiotic treatment of western white pine in Glacier National Park. Surveys requested by the National Park Service were scheduled for certain western white pine areas outside of present blister rust control units to determine what additional areas should be included in the antibiotic control program. Additional antibiotic test plots were designed for limber and whitebark pine. No 1960 work was scheduled in Grand Teton or Rocky Mountain National Parks.

Accomplishments

Ribes eradication was performed on 14,290 acres for an average of .28 man-day per acre. This accomplishment represents more acreage worked at a lower average man-day per acre than ever before in the National Park Service, Region II control program. An additional 2,360 acres were treated with the antibiotic Acti-dione. All goals were achieved except for 10 acres of initial work and some rework in Yellowstone National Park not finished because 1,120 blister rust man-days were lost to forest fire suppression and inclement weather.

In May 1960, an inspection was made of the western white pines treated with Acti-dione during 1959 in Glacier National Park. No. 1 fuel oil was used as a carrier and penetrant. The results of this work appeared to be unsatisfactory. Messrs. Virgil D. Moss and Homer J. Hartman inspected the same areas in June and agreed results were not adequate. Tests then made either by or under the direction of Mr. Moss showed the brand of fuel oil used in 1959 was not compatible with Acti-dione. It was not known until early 1960 that Acti-dione would crystallize when formulated with certain stove oils. Before crew arrival June 13, a brand of oil used successfully in the national forests program was obtained for the 1960 work. Starting July 6, the surfactant Triton B-1956 was added to the formulation as an additional safeguard against crystallization of the Acti-dione. It is now thought that with this additive all western fuel oils can be effectively used. However, each oil delivery was tested for Acti-dione compatibility in advance of its use and the spray solution was prepared on a day-to-day basis.

During the season the 860 acres treated with Acti-dione in 1959 were retreated and an additional 1,500 acres were treated initially. The work averaged .20 man-day per acre. September inspections indicated results should be satisfactory.

Antibiotic Plots

Inspection of the limber and whitebark pine plots established in the Blackfeet Indian Reservation and Two Medicine Lake areas in 1959 showed results were not satisfactory. These plots had been treated with the same incompatible oil formulation as used on the western white pine control areas. Therefore, as an additional test, one-half of each plot was resprayed with the improved surfactant formulation. New nearby check plots were also treated. At Oldman Lake, 3-, 2-, and ½-acre plots of vigorous growing whitebark pine reproduction were treated with surfactant formulations of 150, 175 and 200 ppm of Acti-dione. September inspections indicated results on whitebark pine in the reproduction age class might be satisfactory. Treated limber pine showed very little effect at time of inspections. Another limber pine plot of more vigorous growth, younger age class and on a better site was established on the Custer National Forest as a check. A plot containing older age class trees was treated with Acti-dione in Yellowstone National Park. All plots will be examined when canker fruiting occurs in the spring of 1961 at which time more exacting results can be determined.

Surveys and Observations

Systematic western white pine distribution and disease surveys were made of 10,570 acres in the North Fork Road, Lake McDonald, Avalanche Trail, McDonald Creek, Mineral Creek, Coal Creek and Nyack areas in Glacier National Park. These survey data will be used in determining the feasibility of a control program by antibiotic treatment only, and the selection of areas for inclusion in the program if desirable. Blister rust control by ribes eradication was considered too costly or impractical on these areas when the Glacier National Park program was first formulated in 1939.

Surveys show that blister rust is spreading and intensifying in the unprotected limber and whitebark pine stands adjacent to the Mammoth control unit in Yellowstone National Park. Fruiting cankers can be seen in the vicinity of Glen Creek and Golden Gate. A few reproduction-size trees are already dying from girdling cankers near the Glen Creek water supply intake. Numerous observations made in Yellowstone National Park showed white pine reproduction is growing rapidly and white pine seedlings are occurring in abundance in many lodgepole stands where the canopy is opened by windthrow of the overmature trees. It is now very apparent that white pine will become an important tree species in these areas.

Control Status

There are now 36,440 acres in the maintenance category in the 4 national parks. Included are 4,930 acres in Yellowstone National Park that were worked to this standard in 1960. No changes were made in Glacier National Park control status classifications because ribes seedlings continue to occur in reworked portions of the control units.

Personnel

The requirements in Yellowstone National Park for Foreman I and Foreman II grades were revised to include a broader scope in fields of experience and academic training. For the first time, it was possible to organize supervisory and technically trained men at the beginning of the season, for the best advantage of the work. Forestry students with camp superintendent experience were transferred from Yellowstone National Park to supervise the Glacier National Park operations. Mr. John N. Reeves, Forestry Aid, Yellowstone National Park, worked a 6-week detail on blister rust control field work planning and preparation in the office of the U. S. Forest Service, Region 1, Division of State & Private Forestry, Section of Forest Insect and Disease Control, Missoula, Montana, during January and February. The knowledge he gained in advanced planning contributed considerably to 1960 field accomplishments.

Field Trips and Meetings

Before, during and/or after the field season, inspectional and show-me trips were made to most of the blister rust control areas in Glacier, Yellowstone and/or Grand Teton National Parks by the following men:

U. S. National Park Service

S. T. Carlson, Chief, Branch of Park Forest and Wildlife Protection
Washington, D.C.

Maynard B. Barrows, Forester, National Park Service, Region II,
Moose, Wyoming

U. S. Forest Service

Conrad P. Wessela, Branch Chief, Forest Disease Control, Washington, D.C.

Homer J. Hartman, Section Chief, Forest Insect and Disease Control,
Division of State & Private Forestry, Region 1, Missoula, Montana

Henry J. Viche, In charge of Blister Rust Control Unit, Section of Forest
Insect and Disease Control, Region 1, Missoula, Montana

Virgil D. Moss, Research Forester, D&I Project, Blister Rust Control Unit, Region 1, Spokane, Washington

Merle G. Lloyd, Meteorologist, Intermountain Forest & Range Experiment Station, Inland Empire Research Center, Spokane, Washington

Meetings to discuss plans and progress of the work were held in the parks with Frank W. Childs, Regional Chief of Park Forest and Wildlife Protection, and Ernest K. Field, Assistant Regional Chief, in charge of Park Forest Protection, National Park Service, Region II, Omaha, Nebraska.

Preseason and summer meetings were held with National Park staff officers and district rangers to plan blister rust control operational activities and coordinate them with other phases of forest and visitor protection.

Nearly pure stands of whitebark pine (Pinus albicaulis) in all age classes, near Togwotee Pass, Shoshone National Forest, Wyoming. Blister rust on white pine and ribes has been found 30 miles west of here.

II. STATISTICAL TABLES

Statistical tables summarizing accomplishments and expenditures on a calendar year basis for each program and a total of all programs is presented in this section.

Explanation of the tables for the total program are explained below. The tables for individual programs are the same.

1. Blister Rust Control Expenditures

   Self explanatory.

2. Field Organization

   Self explanatory.

3. Antibiotic Treatment

   Trees treated. This is arrived at from 1/10-acre random sample plots.

4. Total Progress of Ribes Eradication

   a. Working - Initial. The first complete ground coverage to eradicate ribes from an area.

   b. Working - Rework. Ribes eradication performed after initial work and before establishment of control.

   c. Working - Maintenance. Ribes eradication performed on maintenance areas to maintain control.

5. Surveys

   a. Type - Ribes. Includes all types of checking, disease surveys, and pre-eradication surveys done for the purpose of ribes eradication.

   b. Type - Antibiotic. These are all types of survey work done for the purpose of determining areas to be treated with antibiotics.

   Systematic inspection of treated areas to determine effectiveness of work performed is also included.

6. Total Effective Blister Rust Control Field Man-days

   Only the man-days actually spent in the field on one of the activities are included in this table. The man-days for camp construction, camp maintenance, cooks, cook's helpers, clerks, warehousemen, truckdrivers, etc., are not included.

7. Chemical Eradication

   This table shows the acres sprayed with chemicals to eradicate ribes. The application may be from truck-mounted or knapsack sprayers. These data are included in table 4.

8. Acres in White Pine Management Units by Age Classes

The acres reported in this table are for the areas that have been approved for white pine management. The additional areas that will be considered for antibiotic treatment and no ribes eradication are not included.

9. Control Status - Ribes Eradication - White Pine Management Units

This table is also for approved white pine management units only. Antibiotic treatment is not considered in this table, only ribes eradication.

10. Accumulative Summary of Antibiotic Treatment

This table is broken down between white pine management units and areas planned for antibiotic treatment only. As can be seen in the table, areas outside of the units are now being treated where they warrant immediate treatment.

11. Ownership in Blister Rust Control Areas

This ownership table is shown by programs. The state and private lands listed under the national forest program are only those acres that are in the presently approved white pine management units. Likewise, the Federal lands listed in the state and private program are only those acres that are in approved white pine management units.

All of the state and private lands that are outside of presently approved white pine management units are shown under the state and private program and Federal lands are under the national forest program.

SUMMARY OF ALL PROGRAMS

1. Blister Rust Control Expenditures, Calendar Year 1960

State	U. S. Forest Service Region 1 - Funds					National Park Service	State and Private	Total
	720	042	411	K-V	Total			
Idaho	$172,042	$ 910,143	$97,680	$77,317	$1,257,182	-	$72,707	$1,329,889
Mont.	24,429	83,668	-	-	108,097	$ 36,014	-	144,111
Wash.	19,893	147,870	-	12,836	180,599	-	-	180,599
Colo.	2,009	-	-	-	2,009	1,192	-	3,201
Wyo.	6,176	-	-	-	6,176	91,644	-	97,820
Total	$224,549	$1,141,681	$97,680	$90,153	$1,554,063	$128,850	$72,707	$1,755,620

720 - Leadership and technical direction for all programs
042 - National forest program
411 - Federal matching funds for State and Private cooperative programs
K-V - Stand improvement collections used for BRC on national forest lands

2. Field Organization - 1960

Program	Camps	Employees ribes eradication	Employees antibiotic treatment	Total employees	Contractors
National forest	26	262	440	702	30
National park	7	105	10	115	-
State & Private	6	68	102	170	-
All programs	39	435	552	987	30

3. Antibiotic Treatment - 1960

Program	Method	Acres treated	Man-days	Trees treated	Per acre	
					Man-days	Trees treated
National forest	Hand	33,540	17,850	6,921,000	.53	206
	Aerial	1,730	120	440,000	.07	254
	Total	35,270	17,970	7,361,000	.51	209
National parks	Hand	2,360	470	99,000	.20	42
State & Private	Hand	6,420	2,790	951,000	.43	148
All programs	Hand	42,320	21,110	7,971,000	.50	188
	Aerial	1,730	120	440,000	.07	254
	Total	44,050	21,230	8,411,000	.48	191

SUMMARY OF ALL PROGRAMS

4. Total Progress of Ribes Eradication - 1960

Program	Working	Acres	Man-days	Ribes	Per acre	
					Man-days	Ribes
National forest	Initial Rework Maintenance	2,300 5,640 1,530	3,620 4,780 570	471,000 173,000 16,000	1.57 .85 .37	205 31 10
	Total	9,470	8,970	660,000	.95	70
National parks	Initial Rework Maintenance	7,610 2,690 3,990	1,880 1,650 530	498,000 173,000 21,000	.25 .61 .13	65 64 5
	Total	14,290	4,060	692,000	.28	48
State and Private	Initial Rework Maintenance	1,640 650 50	2,170 470 10	400,000 28,000 200	1.32 .72 .20	244 43 4
	Total	2,340	2,650	428,200	1.13	183
All programs	Initial Rework Maintenance	11,550 8,980 5,570	7,670 6,900 1,110	1,369,000 374,000 37,200	.66 .77 .20	119 42 7
	Total	26,100	15,680	1,780,200	.60	68

5. Surveys - 1960

Program	Type	Acres	Man-days
National forest	Ribes Antibiotic	7,240 2,405,670	280 1,280
	Total	2,412,910	1,560
National parks	Ribes Antibiotic	4,120 10,570	50 150
	Total	14,690	200
State and Private	Ribes Antibiotic	4,750 610,460	110 155
	Total	615,210	265
All programs	Ribes Antibiotic	16,110 3,026,700	440 1,585
	Total	3,042,810	2,025

SUMMARY OF ALL PROGRAMS

6. Total Effective BRC Field Man-days - 1960

Program	Ribes eradication	Antibiotic treatment	Surveys	Total
National forest	8,970	17,970	1,560	28,500
National park	4,060	470	200	4,730
State and Private	2,650	2,790	265	5,705
All programs	15,680	21,230	2,025	38,935

7. Chemical Eradication - 1960

Program	Acres	Man-days	Ribes destroyed	Gallons of spray solution	Man-days per acre
National forest	770	1,690	319,000	191,600	2.19
National park	850	1,200	429,000	40,000	1.41
State and Private	155	490	247,000	61,700	3.16
All programs	1,775	3,380	995,000	293,300	1.90

8. Acres in White Pine Management Units by Age Classes

Program	Total acres	Age classes by stand origin				
		1941-1960	1921-1940	1881-1920	1841-1880	Before 1841
National forest	786,490	40,900	153,190	290,260	48,750	253,390
National park	52,960	- - - - - - - Not classified - - - - - -				
State and Private	178,040	26,590	64,500	45,480	6,250	35,220
All programs	1,017,490	67,490	217,690	335,740	55,000	288,610

9. Control Status - Ribes Eradication - White Pine Management Units

Program	Total acres	Unworked acres	Area worked	
			Acres needing rework	Acres on maintenance
National forest	786,490	160,410	290,530	335,550
National park	52,960	4,170	12,350	36,440
State and Private	178,040	33,060	74,350	70,630
All programs	1,017,490	197,640	377,230	442,620

SUMMARY OF ALL PROGRAMS

10. Accumulative Summary of Antibiotic Treatment

Program	Within white pine management units*		Areas outside of white pine management units**		Total	
	Total Acres	Acres treated to date	Total acres	Acres treated to date	Total acres	Acres treated to date
National forest	786,490	43,910	991,200	7,520	1,777,690	51,430
National park	52,960	1,120	1,240	1,240	54,200	2,360
State and Private	178,040	8,430	542,500	-	720,540	8,430
All programs	1,017,490	53,460	1,534,940	8,760	2,552,430	62,220

*White pine management units are those areas that have been approved for the continuous production of western white pine. They are the highest priority units based on volume productivity with ribes eradication that were established following the 1948 and 1949 unit analysis. Additional ribes eradication work will be necessary. Antibiotic treatment will be done where and when necessary.

**Areas outside are those established stands outside of approved white pine management units that by treating the existing stocking with antibiotics the stands could be brought through to a merchantable size. The next crop on these lands will depend on developments in rust resistant pine and antibiotics plus economic changes.

11. Ownership in Blister Rust Control Areas

Program	National forest acres	National park acres	Public domain acres	State acres	Private acres	Total acres
National forest	1,654,990	-	32,020	23,100	67,580	1,777,690
National park	-	54,200	-	-	-	54,200
State and Private	14,430	-	3,830	210,500	491,780	720,540
All programs	1,669,420	54,200	35,850	233,600	559,360	2,552,430

NATIONAL FOREST PROGRAM

1. Expenditures, Calendar Year 1960

Forest	720 Funds	042 Funds	K-V Funds	Total
Clearwater*	$12,289	$208,530	$20,747	$ 241,566
Coeur d'Alene	25,976	210,155	38,928	275,059
Kaniksu*	21,804	286,701	30,095	338,600
Kootenai	6,386	51,346	-	57,732
St. Joe*	18,248	240,633	383	259,264
Total	$84,703	$997,365	$90,153	$1,172,221

*Also had cooperative State and Private Program.

2. Field Organization - 1960

Forest	Camps	Employees ribes eradication	Employees anti-biotic treatment	Total employees	Contractors
Clearwater	4	82	88	170	-
Coeur d'Alene	7	80	106	186	-
Kaniksu	7	60	100	160	30
Kootenai	2	-	26	26	-
St. Joe	6	40	120	160	-
All forests	26	262	440	702	30

3. Antibiotic Treatment - 1960

Forest	Method	Acres treated	Man-days	Trees treated	Per acre	
					Man-days	Trees treated
Clearwater	Hand	3,530	2,940	604,000	.83	171
Coeur d'Alene	Hand	7,000	4,620	2,427,000	.66	347
	Aerial	940	40	282,000	.04	300
	Total	7,940	4,660	2,709,000	.59	341
Kaniksu	Hand	10,510	4,710	2,112,000	.45	201
Kootenai	Hand	1,810	980	319,000	.54	176
St. Joe	Hand	10,690	4,600	1,459,000	.43	136
	Aerial	790	80	158,000	.10	200
	Total	11,480	4,680	1,617,000	.41	141
All forests	Hand	33,540	17,850	6,921,000	.53	206
	Aerial	1,730	120	440,000	.07	254
	Total	35,270	17,970	7,361,000	.51	209

NATIONAL FOREST PROGRAM

4. Total Progress of Ribes Eradication - 1960

Forest	Working	Acres	Man-days	Ribes	Per acre	
					Man-days	Ribes
Clearwater	Initial	1,080	1,720	149,000	1.59	138
	Rework	730	820	20,000	1.12	27
	Maintenance	-	-	-	-	-
	Total	1,810	2,540	169,000	1.40	93
Coeur d'Alene	Initial	740	1,480	273,000	2.00	369
	Rework	890	880	47,000	.99	53
	Maintenance	-	-	-	-	-
	Total	1,630	2,360	320,000	1.45	196
Kaniksu	Initial	150	90	10,000	.60	67
	Rework	3,680	2,610	97,000	.71	26
	Maintenance	1,530	570	16,000	.37	10
	Total	5,360	3,270	123,000	.61	23
St. Joe	Initial	330	330	39,000	1.00	118
	Rework	340	470	9,000	1.38	26
	Maintenance	-	-	-	-	-
	Total	670	800	48,000	1.19	72
All forests	Initial	2,300	3,620	471,000	1.57	205
	Rework	5,640	4,780	173,000	.85	31
	Maintenance	1,530	570	16,000	.37	10
	Total	9,470	8,970	660,000	.95	70

5. Surveys - 1960

Forest	Type	Acres	Man-days
Clearwater	Ribes	2,100	120
	Antibiotic	819,800	300
	Total	821,900	420
Coeur d'Alene	Ribes	2,300	80
	Antibiotic	599,600	200
	Total	601,900	280
Kaniksu	Ribes	2,500	70
	Antibiotic*	900,000	390
	Total	902,500	460
Kootenai	Ribes	-	-
	Antibiotic	8,270	30
	Total	8,270	30
St. Joe	Ribes	340	10
	Antibiotic	78,000	360
	Total	78,340	370
All forests	Ribes	7,240	280
	Antibiotic	2,405,670	1,280
	Total	2,412,910	1,560

*4,700 acres surveyed in the Colville National Forest.

6. Total Effective BRC Field Man-days - 1960

Forest	Ribes eradication	Antibiotic treatment	Surveys	Total
Clearwater	2,540	2,940	420	5,900
Coeur d'Alene	2,360	4,660	280	7,300
Kaniksu	3,270	4,710	460	8,440
Kootenai	-	980	30	1,010
St. Joe	800	4,680	370	5,850
All forests	8,970	17,970	1,560	28,500

NATIONAL FOREST PROGRAM

7. Chemical Eradication - 1960

Forest	Acres	Man-days	Ribes destroyed	Gallons of spray solution	Man-days per acre
Clearwater	270	480	104,000	37,600	1.78
Coeur d'Alene	500	1,210	215,000	154,000	2.42
All forests	770	1,690	319,000	191,600	2.19

8. K-V Work - 1960

Forest	Ribes eradication		Antibiotic treatment		Survey work		Total	
	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days
Clearwater	440	680	-	-	-	-	440	680
Coeur d'Alene	620	820	250	110	350	20	1,220	950
Kaniksu	1,950	990	-	-	1,650	30	3,600	1,020
St. Joe	40	20	-	-	-	-	40	20
All forests	3,050	2,510	250	110	2,000	50	5,300	2,670

9. Contracting Ribes Eradication - 1960

Forest	Number of contractors	Acres	Man-days	Ribes destroyed	Dollars
Kaniksu	39	2,110	1,390	48,000	16,944

10. Acres in White Pine Management Units by Age Classes

Forest	Total acres	Age classes by stand origin				
		1941-1960	1921-1940	1881-1920	1841-1880	Before 1841
Clearwater	178,850	14,190	15,790	38,350	11,460	99,060
Coeur d'Alene	148,220	6,860	24,800	55,000	16,010	45,550
Kaniksu	242,330	14,230	62,160	91,980	10,230	63,730
Kootenai	89,990	420	3,040	39,230	5,550	41,750
St. Joe	127,100	5,200	47,400	65,700	5,500	3,300
All forests	786,490	40,900	153,190	290,260	48,750	253,390

NATIONAL FOREST PROGRAM

11. Control Status - Ribes Eradication - White Pine Management Units

Forest	Total acres	Unworked acres	Area worked	
			Needing rework	On maintenance acres
Clearwater	178,850	82,690	60,620	35,540
Coeur d'Alene	148,220	17,740	71,860	58,620
Kaniksu	242,330	16,640	76,690	149,000
Kootenai	89,990	40,840	14,060	35,090
St. Joe	127,100	2,500	67,300	57,300
All forests	786,490	160,410	290,530	335,550

12. Accumulative Summary of Antibiotic Treatment

Forest	Within white pine management units*		Areas outside of white pine management units**		Total	
	Total acres	Acres treated to date	Total acres	Acres treated to date	Total acres	Acres treated to date
Clearwater	178,850	5,120	168,800	80	347,650	5,200
Coeur d'Alene	148,220	6,980	327,720	2,410	475,940	9,390
Kaniksu	242,330	12,120***	272,930	2,830****	515,260	14,950
Kootenai	89,990	1,130	17,550	2,000	107,540	3,130
St. Joe	127,100	18,560	204,200	200	331,300	18,760
All forests	786,490	43,910	991,200	7,520	1,777,690	51,430

*White pine management units are those areas that have been approved for the continuous production of western white pine. They are the highest priority units based on volume productivity with ribes eradication that were established following the 1948 and 1949 unit analysis. Additional ribes eradication work will be necessary. Antibiotic treatment will be done where and when necessary.

**Areas outside are those established stands outside of approved white pine management units that by treating the existing stocking with antibiotics the stands could be brought through to a merchantable size. The next crop on these lands will depend on developments in rust resistant pine and antibiotics plus economic changes.

***Includes 510 acres treated in the Colville National Forest.

****Includes 70 acres treated in the Colville National Forest.

13. Ownership in National Forest Areas

Forest	State	National forest acres	Public domain acres	State acres	Private acres	Total acres
Clearwater	Idaho	333,190	2,570	3,540	8,350	347,650
Coeur d'Alene	Idaho	428,180	14,660	1,420	1,240	445,500
	Montana	26,840	-	-	3,600	30,440
	Total	455,020	14,660	1,420	4,840	475,940
Kaniksu	Idaho	255,930	530	3,770	19,210	279,440
	Montana	60,020	-	640	1,960	62,620
	Washington*	169,250	60	830	3,060	173,200
	Total	485,200	590	5,240	24,230	515,260
Kootenai	Idaho	15,820	-	-	-	15,820
	Montana	90,460	-	-	1,260	91,720
	Total	106,280	-	-	1,260	107,540
St. Joe	Idaho	275,300	14,200	12,900	28,900	331,300
Total	Idaho	1,308,420	31,960	21,630	57,700	1,419,710
	Montana	177,320	-	640	6,820	184,780
	Washington	169,250	60	830	3,060	173,200
Grand total		1,654,990	32,020	23,100	67,580	1,777,690

*Includes 45,130 acres in the Colville National Forest.

STATE AND PRIVATE PROGRAM

1. Expenditures, Calendar Year 1960

Timber protective association	Federal funds			State and private funds			Total all funds
	720	411	Total	State	Private	Total	
Clearwater	$ 5,655	$48,362	$ 54,017	$16,407	$10,603	$27,010	$ 81,027
Potlatch	6,082	34,655	40,737	16,980	8,611	25,591	66,328
Priest Lake	2,000	14,663	16,663	9,814	6,292	16,106	32,769
Total	$13,737	$97,680	$111,417	$43,201	$25,506	$68,707	$180,124

Clearwater National Forest administers the Clearwater TPA program.
St. Joe National Forest administers the Potlatch TPA program.
Kaniksu National Forest administers the Priest Lake TPA program.

720 - Leadership funds.
411 - Federal matching funds.

2. Field Organization - 1960

Area	Camps	Employees ribes eradication	Employees antibiotic treatment	Total employees
Clearwater TPA	2	38	42	80
Potlatch TPA	2	30	30	60
Priest Lake TPA	2	-	30	30
All areas	6	68	102	170

3. Antibiotic Treatment - 1960

Area	Method	Acres treated	Man-days	Trees treated	Per acre	
					Man-days	Trees treated
Clearwater TPA	Hand	970	800	331,000	.82	341
Potlatch TPA	Hand	3,230	1,170	340,000	.36	105
Priest Lake TPA	Hand	2,220	820	280,000	.37	126
All areas	Total	6,420	2,790	951,000	.43	148

STATE AND PRIVATE PROGRAM

4. Total Progress of Ribes Eradication - 1960

Area	Working	Acres	Man-days	Ribes	Per acre	
					Man-days	Ribes
Clearwater TPA	Initial	790	990	34,000	1.25	43
	Rework	200	230	3,000	1.15	15
	Maintenance	-	-	-	-	-
	Total	990	1,220	37,000	1.23	37
Potlatch TPA	Initial	850	1,180	366,000	1.39	431
	Rework	450	240	25,000	.53	56
	Maintenance	50	10	200	.20	4
	Total	1,350	1,430	391,200	1.06	290
All areas	Initial	1,640	2,170	400,000	1.32	244
	Rework	650	470	28,000	.72	43
	Maintenance	50	10	200	.20	4
	Total	2,340	2,650	428,200	1.13	183

5. Surveys - 1960

Area	Type	Acres	Man-days
Clearwater TPA	Ribes	950	50
	Antibiotic	413,700	55
	Total	414,650	105
Potlatch TPA	Ribes	3,800	60
	Antibiotic	10,130	90
	Total	13,930	150
Priest Lake TPA	Antibiotic	186,630	10
All areas	Ribes	4,750	110
	Antibiotic	610,460	155
	Total	615,210	265

6. Total Effective BRC Field Man-days - 1960

Area	Ribes eradication	Antibiotic treatment	Surveys	Total
Clearwater TPA	1,220	800	105	2,125
Potlatch TPA	1,430	1,170	150	2,750
Priest Lake TPA	-	820	10	830
All areas	2,650	2,790	265	5,705

7. Chemical Eradication - 1960

Area	Acres	Man-days	Ribes destroyed	Gallons of spray solution	Man-days per acre
Clearwater TPA	35	100	13,000	14,900	2.86
Potlatch TPA	120	390	234,000	46,800	3.25
All areas	155	490	247,000	61,700	3.16

8. Acres in White Pine Management Units by Age Classes

Area	Total acres	Age classes by stand origin				
		1941-1960	1921-1940	1881-1920	1841-1880	Before 1841
Clearwater TPA	69,960	11,830	34,770	5,200	2,840	15,320
Potlatch TPA	63,200	13,700	16,900	20,900	2,300	9,400
Priest Lake TPA	44,880	1,060	12,830	19,380	1,110	10,500
All areas	178,040	26,590	64,500	45,480	6,250	35,220

9. Control Status - Ribes Eradication - White Pine Management Units

Area	Total acres	Unworked acres	Area worked	
			Needing rework	On maintenance acres
Clearwater TPA	69,960	19,470	28,460	22,030
Potlatch TPA	63,200	9,300	31,000	22,900
Priest Lake TPA	44,880	4,290	14,890	25,700
All areas	178,040	33,060	74,350	70,630

10. Accumulative Summary of Antibiotic Treatment

Areas	Areas within white pine management units*		Areas outside white pine management units**		Total	
	Total acres	Acres treated to date	Total acres	Acres treated to date	Total acres	Acres treated to date
Clearwater TPA	69,960	1,310	218,400	-	288,360	1,310
Potlatch TPA	47,800	3,880	95,600	-	143,400	3,880
Priest Lake TPA	34,000	3,240	39,200	-	73,200	3,240
Other S&P***						
Clearwater	-	-	12,800	-	12,800	-
Coeur d'Alene	-	-	60,830	-	60,830	-
Kaniksu	10,880	-	51,670****	-	62,550	-
St. Joe	15,400	-	64,000	-	79,400	-
All areas	178,040	8,430	542,500	-	720,540	8,430

*White pine management units are those areas that have been approved for the continuous production of western white pine. They are the highest priority units based on volume productivity with ribes eradication that were established following the 1948 and 1949 unit analysis. Additional ribes eradication work will be necessary. Antibiotic treatment will be done where and when necessary.

**Areas outside are those established stands outside of approved white pine management units that by treating the existing stocking with antibiotics the stands could be brought through to a merchantable size. The next crop on these lands will have to depend on developments in rust resistant pine and antibiotics plus economic changes.

***Other State and Private are those state and private lands outside of the Timber Protective Association boundaries.

****Includes 5,870 acres in the Colville National Forest.

11. Ownership in State and Private Areas

Area	State	State acres	Private acres	Public domain acres	National forest acres	Total acres
Clearwater TPA	Idaho	95,400	189,540	1,330	2,050	288,360
Potlatch TPA	Idaho	40,600	99,900	100	2,800	143,400
Priest Lake TPA	Idaho	33,730	37,510	-	1,960	73,200
Other State & Private Clearwater	Idaho	1,500	11,300	-	-	12,800
Other State & Private Coeur d'Alene	Idaho	13,620	46,300	-	-	59,920
	Montana	-	910	-	-	910
	Total	13,620	47,210	-	-	60,830
Other State & Private Kaniksu	Idaho	2,200	3,560	-	5,120	10,880
	Montana	30	4,810	-	-	4,840
	Washington	4,980	41,850	-	-	46,830
	Total	7,210	50,220	-	5,120	62,550
Other State & Private St. Joe	Idaho	18,400	56,100	2,400	2,500	79,400
Total	Idaho	205,490	444,210	3,830	14,430	667,960
	Montana	30	5,720	-	-	5,750
	Washington	4,980	41,850	-	-	46,830
Grand Total		210,500	491,780	3,830	14,430	720,540

NATIONAL PARKS PROGRAM

1. Expenditures, Calendar Year 1960

National park	National park BRC	Forest Service leadership and technical direction	Totals
Glacier	$ 36,014	$ 4,809	$ 40,823
Grand Teton	-	213	213
Rocky Mountain	1,192	855	2,047
Yellowstone	91,644	4,809	96,453
All parks	$128,850	$10,686	$139,536

2. Field Organization - 1960

National park	Camps	Employees ribes eradication	Employees antibiotic treatment	Total employees
Glacier	3	15	10	25
Yellowstone	4	90	-	90
Totals	7	105	10	115

3. Total Progress of Ribes Eradication - 1960

National park	Working	Acres	Man-days	Ribes	Per acre	
					Man-days	Ribes
Glacier	Initial	60	110	31,000	1.83	517
	Rework	610	350	28,000	.57	46
	Maintenance	510	110	5,000	.22	10
	Total	1,180	570	64,000	.48	54
Yellowstone	Initial	7,550	1,770	467,000	.23	62
	Rework	2,080	1,300	145,000	.63	70
	Maintenance	3,480	420	16,000	.12	5
	Total	13,110	3,490	628,000	.27	48
All parks	Initial	7,610	1,880	498,000	.24	65
	Rework	2,690	1,650	173,000	.61	64
	Maintenance	3,990	530	21,000	.13	5
	Total	14,290	4,060	692,000	.28	48

NATIONAL PARKS PROGRAM

4. Antibiotic Treatment - 1960

National park	Method	Acres treated	Man-days	Trees treated	Per acre	
					Man-days	Trees treated
Glacier	Hand	2,360	470	99,000	.20	42

5. Surveys - 1960

National park	Type	Acres	Man-days
Glacier	Antibiotic	10,570	150
Yellowstone	Ribes	4.120	50
All parks	Total	14,690	200

6. Total Effective BRC Field Man-days - 1960

National park	Ribes eradication	Antibiotic treatment	Surveys	Total
Glacier	570	470	150	1,190
Yellowstone	3,490	-	50	3,540
All parks	4,060	470	200	4,730

7. Chemical Eradication

National park	Acres	Man-days	Ribes destroyed	Gallons of solution	Man-days per acre
Glacier	60	110	36,000	3,700	1.83
Yellowstone	790	1,090	393,000	36,300	1.38
All parks	850	1,200	429,000	40,000	1.41

8. Control Status Ribes Eradication in White Pine Management Units

National park	Total acres	Unworked acres	Worked area: Needing rework acres	Worked area: On maintenance acres
Glacier	6,010	110	1,900	4,000
Grand Teton	1,010	-	100	910
Rocky Mountain	12,650	4,050	600	8,000
Yellowstone	33,290	10	9,750	23,530
All parks	52,960	4,170	12,350	36,440

9. Accumulative Summary of Antibiotic Treatment

National park	Within control units*: Total acres	Within control units*: Acres treated to date	Outside control units**: Total acres	Outside control units**: Acres treated to date	Total: Total acres	Total: Acres treated to date
Glacier	6,010	1,120	1,240	1,240	7,250	2,360
Grand Teton	1,010	-	-	-	1,010	-
Rocky Mountain	12,650	-	-	-	12,650	-
Yellowstone	33,290	-	-	-	33,290	-
All parks	52,960	1,120	1,240	1,240	54,200	2,360

*Are those areas that have been approved for blister rust control with ribes eradication and/or antibiotic treatment.

**Are those additional areas outside of control units that have been approved for blister rust protection through antibiotics, alone. Ribes will not be eradicated from these areas.

III. ANTIBIOTIC DEVELOPMENT AND IMPROVEMENT WORK - 1960

Virgil D. Moss, Forester in Charge
Theodore R. Peterson, Research Forester
Wayne E. Bousfield, Research Forester

Project activities in the laboratory and field in 1960 included: (1) checking the results of 1959 tests, (2) establishing aerial spray tests cooperatively with the blister rust control projects in the St. Joe and Coeur d'Alene National Forests in May and September, (3) testing cycloheximide methylhydrazone and new formulations of Acti-dione BR and phytoactin by the basal stem and foliar spray methods, (4) testing antibiotics in the nursery to immunize seedlings from blister rust infection, (5) collecting needles, bark, and wood for bioassay to measure the absorption, translocation, and persistence of antibiotics in trees aerially sprayed and treated by the basal stem method, and (6) artificial inoculation with blister rust of previously treated trees. Progress of these studies and results of 1959 tests are outlined in this report.

A. Antibiotic Tests on Infected White Pine

1. Results of 1959 tests

a. Basal stem method. The Forest Service-Upjohn Company study, statistically designed to test 138 cycloheximide formulations on pole-size trees in the Kaniksu National Forest was examined by an 8-man crew in June. Data form sheets and three of the four checkers in the crew were supplied by The Upjohn Company. The Forest Service furnished one checker and four tabulators. Data of this test will be analyzed by Upjohn statisticians. The study will be completed and the results reported after trees are re-examined in 1961.

Basal stem tests from 1957 through 1959 as well as project crew work have demonstrated the importance of thorough spray coverage to obtain good results in treating western white pine. Spray solution must be generously applied to the point of runoff or saturation for bark absorption of the antibiotic. Spraying white pine is no different than spraying ribes, for the results in treating both are in direct proportion to the thoroughness of spray application.

Two physical factors in spray solution were found that could cause poor results by the basal stem method: (1) the affinity between water and cycloheximide, and (2) incompatibility of Acti-dione and some brands of stove oil. Water in a tank, can, or sprayer containing prepared spray solution, extracts the antibiotic from the oil to seriously lower the dosage of cycloheximide applied to trees. Containers used to mix, store, and spray antibiotic solution should be regularly inspected to keep free of water. The second factor that can contribute to poor results is the chemical process of the antibiotic crystallizing in some brands of stove oil in this region. A corrective measure to prevent this reaction is the addition of 32 fluid ounces of Triton B-1956 to each 100 gallons of oil used in preparing spray solution.

b. Aerial spray tests.

The following is copied from a special report prepared in December 1960:

Preliminary Results of Aerial Application of Antibiotics for the Control of White Pine Blister Rust

By
Virgil D. Moss
Research Forester
Blister Rust Control
Division of State and Private Forestry

The results of the 1959 tests in the helicopter spraying of antibiotics for the control of white pine blister rust are presented in this report.

First, it will be of interest to review the performance records of the antibiotics in screening tests where foliar spray solution was applied by a backpack compressed air sprayer. From these tests in 1957 and 1958 on 15- to 20-year-old western white pine, the percentages of all blister rust cankers killed by the antibiotics were as follows: Acti-dione BR, (50, 100, 150 and 200 ppm), 67, 69, 85, and 79 percent; semicarbazone, (50, 100, 150, and 200 ppm), 72, 83, 85, and 84 percent; and phytoactin, (100, 200, 400, and 800 ppm), 72, 82, 89, and 89 percent, respectively.

Biological activity of the antibiotics can be directly compared at concentrations of 100 and 200 ppm. The percentages of all blister rust cankers killed at these concentrations are as follows: Acti-dione BR, 67 and 69 percent; semicarbazone, 72 and 83 percent; and phytoactin, 72 and 82 percent, respectively. Semicarbazone and phytoactin results were similar in the screening tests. (Data in reference were taken from Table 1 of the manuscript, "Antibiotics in the Control of Blister Rust on Western White Pine," which was recently submitted for publication in Forest Science.)

The antibiotics were observed to widely differ in phytotoxicity in the screening tests. Acti-dione BR and all cycloheximide derivatives except methylhydrazone (tested in 1960) caused trees to cast 2- and 3-year-old needles. In addition, Acti-dione BR and the acetate, acetoacetate, and thiosemicarbazone derivatives of cycloheximide, 150 and 200 ppm, injured new shoots in lower branches of trees sprayed in the flush growth-period. Phytoactin had no harmful side effects at the concentrations tested.

The results of the aerial spray tests in 1959 are next presented in this report. Trees in the plots sprayed by helicopter in 1959 were examined in May and again in September of 1960. Criteria used to differentiate live and dead cankers were aeciospore and pycniospore stages and parasitism by the purple mold fungus, Tuberculina maxima. A fourth criteria, bark discoloration was used to classify cankers of a questionable status this year. Cankers placed in this classification by the crew of observers were personally examined for biological activity in October. Eighty percent of the cankers inspected were in late stages of necrosis with parenchymatous scar tissue around canker margins. On this evidence they were classed as dead in 1960. Twenty percent of the cankers first placed in a questionable status were so retained on the basis of yellowish-orange color characterizing cortical tissue discoloration from blister rust infection.

A summary to show the results of aerial spraying the antibiotics on a canker and on a tree basis is presented in Table 1. On a canker basis, dead cankers are expressed as a percent of the total cankers on the trees marked for treatment observation. On a tree basis the statistics include the trees that the antibiotic killed all blister rust infections. Cankers of good color were retained in a questionable status to be examined again in 1961. In this table, plot treatments consisting of three concentrations each have been combined in a summary to compare the overall effectiveness of the antibiotics on western white pine. Phytoactin was diluted in water containing a surfactant, while semicarbazone was diluted in 20 percent oil emulsion.

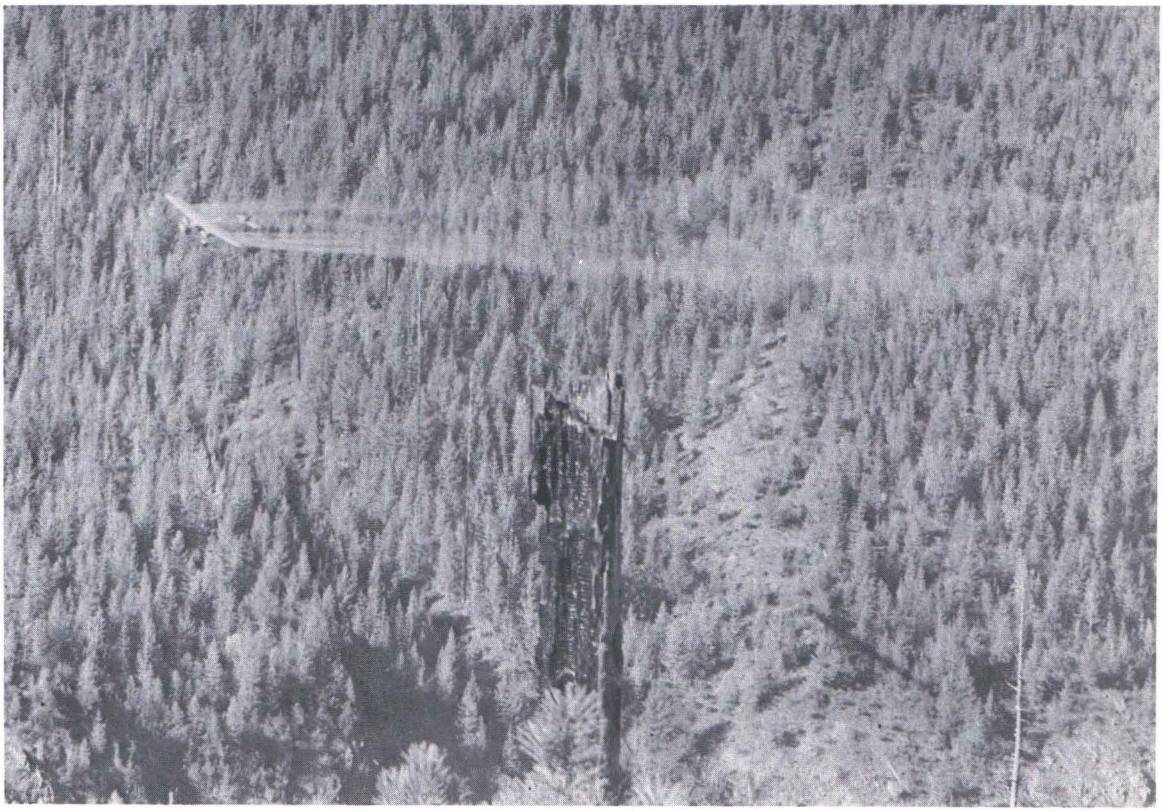
Table 1: Summary of the effectiveness of aerial spraying in 1959

				Treatment results in percent cankers killed					
				Canker basis			Tree basis		
Plot Nos.	Antibiotic & ppm.	Stand age years	Tree crown class	Cankers live	Cankers dead	Questionable status	Cankers live	Cankers dead	Questionable status
1, 2 & 3	Phytoactin 100, 200 & 400	40-60	Open	19	78	3	22	77	1
			Half	26	71	3	28	70	2
			Full	35	62	3	46	54	0
			Total	24	73	3	28	70	2
7, 8 & 9	Phytoactin 100, 200, & 400	25	Open	24	69	7	16	77	7
			Half	34	59	7	33	60	7
			Full	42	52	6	54	46	0
			Total	29	65	6	25	68	7
10, 11, & 12	Semicarbazone	25	Open	21	71	8	19	72	9
			Half	19	73	8	29	62	9
			Full	37	55	8	41	53	6
			Total	22	70	8	25	66	9

Biological effects of the antibiotics in general are noted as follows: (1) On a tree basis in a 25-year-old stand, both antibiotics were about equally effective on trees of all crown classes. Phytoactin shows some advantage on trees in the open while semicarbazone appears to give better results under hald and full canopy conditions. (2) On a canker basis in the 25-year-old stand, semicarbazone generally was more effective than phytoactin. Any difference in the percent of cankers killed is not considered significant at this time because in the final analysis treatments will be evaluated on a tree basis. (3) There is evidence to show that aerial spray effectiveness may increase with size of tree. This is indicated in comparing the results of phytoactin treatment on 25-year-old as against 40- to 60-year-old trees. (4) The general trend of effectiveness of both antibiotics in aerial spraying is downward from trees in the open to trees growing under half and full canopy conditions.

The statistics for individual plots to compare treatments on a tree and on a canker basis are presented in Table 2. To reiterate, phytoactin was diluted in water containing a surfactant while semicarbazone and Acti-dione (LC-657) were diluted in 20 percent oil emulsion.

G-2 helicopter treating a heavily infected 40-year-old stand of western white pine. Helicopter sprayed 30 acres per hour with a coverage of 10 gallons per acre. St. Joe National Forest.



Ford Tri-Motor spraying a heavily infected 30-year-old western white pine plantation with a solution of semicarbazone. Spray plane carries 400 gallons of solution per load. Coeur d'Alene National Forest.

Table 2: Results of individual treatments from aerial spray tests in 1959

				Treatment results in percent cankers killed					
				Canker basis			Tree basis		
Plot No.	Antibiotic and ppm.	Stand age years	Tree crown class	Cankers live	Cankers dead	Questionable status	Cankers live	Cankers dead	Questionable status
	Phytoactin								
1	100	40-60	Open	41	58	1	43	57	0
			Half	42	58	0	39	61	0
			Full	44	56	0	60	40	0
			Total	42	57	1	42	58	0
2	200	40-60	Open	23	76	1	29	70	1
			Half	22	76	2	33	61	6
			Full	20	76	4	40	60	0
			Total	22	76	2	33	65	2
3	400	40-60	Open	8	89	3	9	88	3
			Half	1	87	12	5	85	10
			Full	33	60	7	33	66	1
			Total	8	87	5	9	86	5
9	100	25	Open	20	72	8	24	69	7
			Half	30	62	8	27	65	8
			Full	40	52	8	75	25	0
			Total	24	68	8	27	66	7
7	200	25	Open	9	83	8	10	82	8
			Half	9	81	10	13	78	9
			Full	0	90	10	0	90	10
			Total	8	82	10	11	81	8
8	400	25	Open	29	60	11	21	75	4
			Half	33	59	8	31	60	9
			Full	86	14	0	60	40	0
			Total	33	58	9	29	66	5
	Semicarbazone								
10	100	25	Open	14	75	11	4	83	13
			Half	12	76	12	15	70	15
			Full	38	51	11	50	38	12
			Total	16	73	11	11	75	14
12	200	25	Open	24	70	6	27	64	9
			Half	16	79	5	29	65	6
			Full	50	50	0	0	0	0
			Total	20	74	6	28	64	8
11	400	25	Open	31	63	6	39	55	6
			Half	30	63	7	43	52	5
			Full	33	62	5	33	55	12
			Total	31	63	6	39	52	9
	Acti-dione (LC-657)								
13	100	25	Open	34	63	3	36	59	5
			Half	33	60	7	50	50	0
			Full	0	45	55	67	33	0
			Total	35	62	13	40	55	5

Phytoactin results on a tree basis are noted as follows: In the 40- to 60-year-old stand, the percent of the cankers killed increased with the amount (concentration) of antibiotic applied per acre. The difference may not be significant when data are statistically analyzed, however, because Plot 3 has twice as many trees as Plot 2 and 1 in open canopy conditions. In the 25-year-old stand, phytoactin, 200 ppm, was more effective than 100 and 400 ppm. The apparent variation in the percent of the cankers killed by the three concentrations in the two age classes of western white pine can be the result of more than one individual checking of plots. In 1961, all plots will be examined by one person to reduce the variability in canker reading. Also, 1961 data will be statistically analyzed to account for variance attributable to stand age, crown class, and antibiotic concentration.

Semicarbazone results on a tree basis in the 25-year-old stand are noted as follows: The percent of the cankers killed decreased as more antibiotic was applied per acre. The fact that 100 ppm killed more cankers than 200, and 200 ppm in turn killed more cankers than 400, suggests different degrees of phytotoxicity and time required for spray penetration. Whether needle cast was faster from trees sprayed with 400 than 200 and 100 ppm is not known for when plots were first examined after spraying (approximately 6 weeks) trees had cast all 2- and 3-year-old needles. A significant amount of semicarbazone very probably never reaches a branch before the 2- and 3-year-old needles drop. The amount of antibiotic lost could be as much as two-thirds of the dosage reaching a tree, since the 2- and 3-year-old needles theoretically represent two-thirds of all the foliage of a western white pine tree. To determine the amount of semicarbazone in various aged needles, needle samples were collected and are being presently bioassayed for trees aerially sprayed in September 1960.

It is noted that semicarbazone, 200 ppm, killed 84 percent of all cankers in the screening test but only 64 percent on a tree basis in the aerial spray test. One factor probably responsible for the higher percent kill in the screening test is the larger volume of solution applied to each tree by the backpack compressed air sprayer. Also, there would be some wetting of shoots and branches in applying spray from a distance of 3 to 4 feet from a tree. Another factor that might account for the higher percent kill in the screening test is the selection of trees in the open and the completeness of spray coverage.

Acti-dione (LC-657), 100 ppm, killed 55 percent of the cankers on a tree basis in the 25-year-old stand while semicarbazone, 100 ppm, killed 75 percent. Both were similarly phytotoxic causing trees to cast all 2- and 3-year-old needles. However, no harmful side effects were observed on tree development in 1960, one year after spraying.

Heretofore, it was not possible to compare both antibiotics in the same diluent because phytoactin had been mixed in water and semicarbazone in 20 percent oil emulsion. In May 1960, plots of each antibiotic at 200 ppm in 20 percent oil emulsion were sprayed by helicopter. In examining 50 trees each in the two plots (Plots 17 and 29), November 3 and 4, the percent of all cankers killed to date with phytoactin and semicarbazone was 76 and 72, respectively. Plots are in a 40- to 60-year-old stand. Biological action of the antibiotics is far more advanced this year than last in a similar 5-month period following spray treatment. I believe much of this can be attributed to the improvements in equipment for the preparation and application of oil emulsion sprays.

It was noted in examining the plots sprayed by helicopter in 1959 that the biological action of the antibiotics was not complete 15 months after treatment when the present results were read in September 1960. This is encouraging, for it suggests the persistence of the antibiotics in the trees. As a result, some improvement in the effectiveness of aerial spray treatment can be expected before reading the plots in 1961. Based on the amount of canker margin already killed by the antibiotic, phytoactin results are expected to improve more than semicarbazone in the next year. Semicarbazone inspection results in May 1960 were more encouraging than the results in September 1960 with one exception: On 25-year-old trees, semicarbazone, 100 ppm, reportedly killed 61.5 percent of the cankers in May and 75 percent of the cankers in September. Phytoactin results for concentrations of 100 and 200 ppm were better in September 1960 than in May 1960 with an exception in the case of 400 ppm that reportedly killed 72.6 percent of the cankers in May and 66 percent in September.

Cycloheximide methylhydrazone results are not available from the plots sprayed in May and October 1960. Differing from other cycloheximide derivatives tested to date, methylhydrazone is free of phytotoxicity in the flush and rest growth-periods.

Recommendations - Spring of 1961

The following recommendations are made for antibiotic spraying by helicopter on a project basis in the spring of 1961:

1. Phytoactin (L-318) diluted in 20 percent oil emulsion presently is the best candidate for aerial spraying western white pine in the flush growth-period.

2. Phytoactin dosage and spray volume to be calculated on the basis of 200 ppm and 10 gallons of solution per acre in the interim period until 1960 spray plots with volume rates of 5, 7 and 10 gallons of solution per acre are examined in the spring of 1961.

3. No aerial spraying of stands less than 25 years of age.

4. Phytoactin, methylhydrazone and semicarbazone will be evaluated in June of 1961 for aerial spraying on a project basis in the fall of 1961.

End of report

c. Seedling immunization. Cycloheximide and its acetate, acetoacetate, semicarbazone, and thiosemicarbazone proved too toxic for seedling treatment in the nursery. The oxime and methylhydrazone derivatives at concentrations not exceeding 100 ppm proved relatively safe to apply as a soil drench to 1-, 2-, and 3-year-old seedlings. The oxime was not a good prophylactic for western white pine seedlings in this test, however. The results in testing methylhydrazone in 1960 will not be known until August 1961.

Phytoactin has been the most promising antibiotic to date for seedling treatment by the soil drench method in the nursery. The antibiotic has established the highest degree of immunity without serious injury to to seedlings. Seedling immunity is observed to increase with the percent of surfactant in phytoactin aqueous solution. As an illustration, phytoactin, 100 ppm, aqueous solution with Triton X-155 afforded seedling protection from one artificial inoculation as follows:

Triton X-155	Seedling survival	Seedlings noninfected
	Percent	
0.025	97	67
0.050	100	74
0.100	97	92

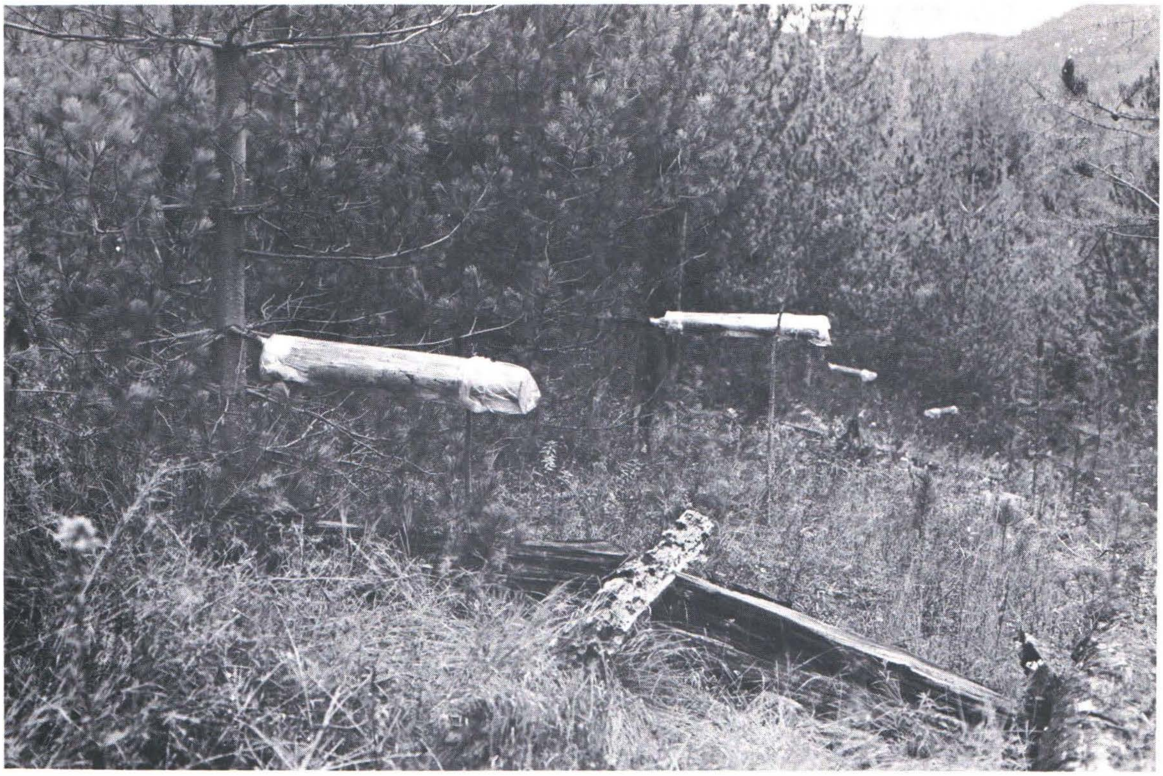
2. Antibiotic tests in 1960.

a. Aerial spray tests. Helicopter and a fixed-wing plane (Ford Tri-Motor) were used in the spring and again in the fall to apply phytoactin and several derivatives of cycloheximide. In the spring, sprays were tested in the St. Joe National Forest and in the fall, in the Coeur d'Alene National Forest. Dates of spraying were May 23 to 28 and September 13 to 20, respectively.

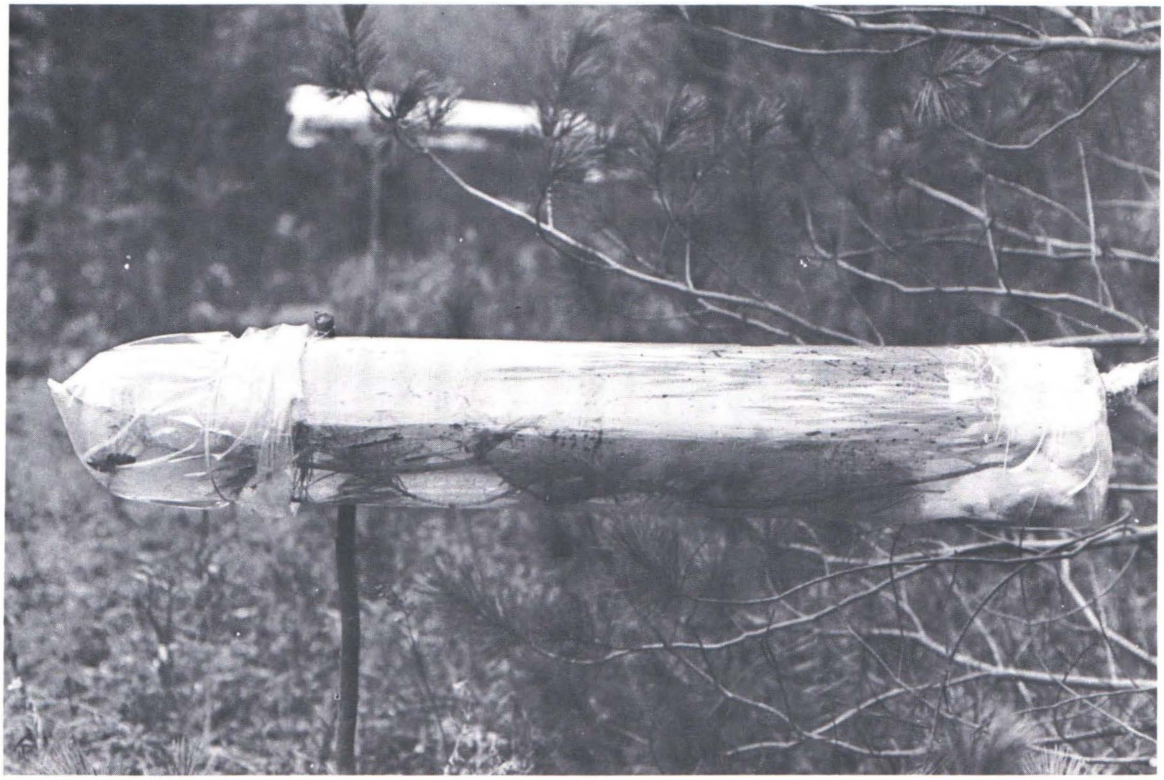
In May, phytoactin (Formulation L-318) diluted in aqueous solution and in 10 percent and 20 percent oil emulsion was sprayed to compare volume rates of 5 gallons and 10 gallons solution per acre applied by helicopter to 20-acre-sized plots. The equivalent amount of phytoactin was applied at the volume rates of 5 gallons and 10 gallons per acre, namely, 400 ppm and 200 ppm, respectively. Four additional 20-acre plots were sprayed with water soluble (L-382 and L-387) and oil emulsion (L-390 and L-395) forms of phytoactin, 200 ppm, in a volume of 10 gallons per acre. Five 80-acre plots were sprayed by fixed-wing plane to compare phytoactin dosages (200 and 400 ppm), diluents (aqueous and 10 percent and 20 percent oil emulsion), and the volume rates of 5 gallons and 10 gallons solution per acre.

Cycloheximide semicarbazone, thiosemicarbazone, and methylhydrazone were applied by helicopter to five 10-acre plots at a volume rate of 10 gallons of solution per acre. Semicarbazone and thiosemicarbazone dosage rate was 200 ppm, and methylhydrazone, 100, 200, and 400 ppm. Age class of western white pine was 41 to 60 years in both cycloheximide and phytoactin plots sprayed in May. The two derivatives of cycloheximide, semicarbazone and thiosemicarbazone caused trees to cast 2- and 3-year-old needles while methylhydrazone and phytoactin were free of phytotoxicity.

In September 1960, seven plots were sprayed by helicopter and one by fixed-wing plane. In the helicopter plots, the antibiotic and acreages sprayed included (1) phytoactin (L-318), 100 acres, (2) phytoactin (L-395), 100 acres, and the derivatives of cycloheximide (3) methylhydrazone, 100 acres, (4) semicarbazone, 143 acres, (5) semicarbazone GAB-1,



Branches being artificially inoculated with blister rust to measure the infection immunity period resulting from a single application of the antibiotic in western white pine. Trees were basal stem treated with Acti-dione by field crews in 1959. Kalispell Creek Plantation, Kaniksu National Forest.



Field inoculation chamber. Consists of plastic cylinder, plastic bag and wrap for ends, water-soaked cotton, and rust infected ribes leaves. Inoculation period lasts one week.

13 acres, (6) semicarbazone GAB-2, 15 acres, and (7) methylhydrazone GAB-3, 7 acres. A 7-acre plot to observe only the diluent used in these tests was sprayed with a 20 percent oil emulsion. A 460-acre plot of semicarbazone in the same diluent was sprayed by fixed-wing plane. Western white pines were 21- to 40-years old in the spray tests made in September. Only semicarbazone GAB-1 was phytotoxic in the rest growth-period.

In all the plots, treatment results will be based on trees that were carefully selected to assure active trunk and branch infections at time of spraying.

b. Basal stem tests.

(1) Retreatment of trees to kill cankers surviving basal stem treatment. Trees were retreated in 1960 in a study to determine the chemical and physical factors responsible for the occasional poor results of crew treatment by the basal stem method in 1959. The factors in question on two areas selected for the retreatment tests by the basal stem method included: (1) possible resistance of cankers to antibiotic activity, (2) oil used that caused the antibiotic to crystallize in spray solution, (3) water in spray containers, and (4) trunks wet from rain and base of some covered by snow when trees were treated on one area in early May. The tests were made on pole-size western white pine located in Lone Cabin Creek and in Hamilton Creek drainages, Coeur d'Alene National Forest.

The Lone Cabin and Hamilton Creek stands were treated by regular crews in early May and late August 1959, respectively. Poor infection kill resulted in the Lone Cabin Creek stand that was treated in early May 1959. In Hamilton Creek, poor results were reported from a spring inspection in 1960, but a check later in the season showed that satisfactory control had been established. The Hamilton Creek area demonstrates the importance of proper timing the check of an area to take advantage of the full effects of the antibiotic.

Antibiotic formulation and number of trees treated at each area were as follows:

Number trees	Acti-dione BR ppm	Triton B-1956 fl. oz. per gal. oil
20	150	.00
20	150	.32
20	150	.50
20	Check	.00

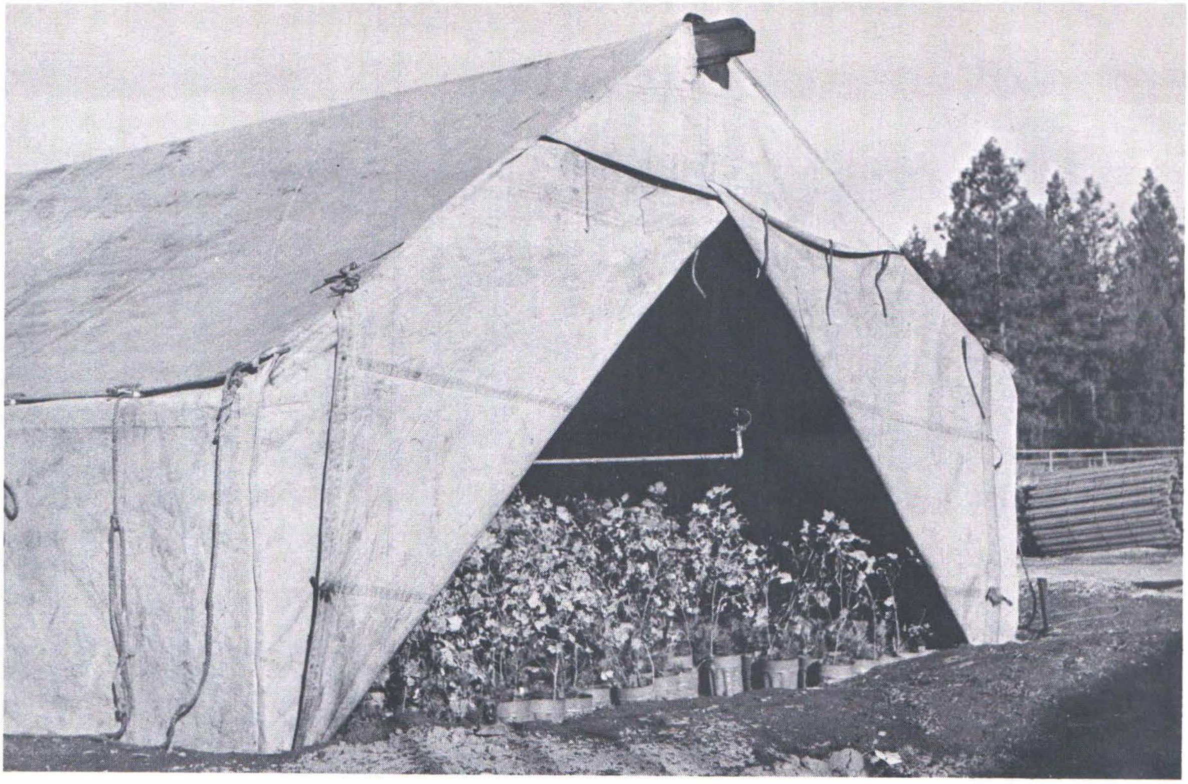
(2) Testing stove oils from other regions. Stove oil from Regions 1, 7, and 9 was used as a diluent for Acti-dione in basal stem tests jointly conducted in the three regions. Purpose of the study is to compare Acti-dione results in the three oils on western white pine in the West and eastern white pine in the East. Each region interchanged oils so that each would make identical tests. The procedure consisted of basal stem treating two age-classes, 10- to 20-year-old and 21- to 40-year-old white pine with the following Acti-dione formulations in each of the three oils: (1) straight oil, (2) 75 ppm Acti-dione, (3) 150 ppm Acti-dione, and (4) 300 ppm Acti-dione. Tests were replicated in flush (May to mid-July), rest (August-September), and dormant (October-November) growth-periods.

c. Foliage sprays. The methylhydrazone derivative of cycloheximide was applied by backpack compressed air sprayer to the foliage of 4- to 8-foot high western white pine. Trees selected had both trunk and branch cankers. The antibiotic was applied at concentrations of 100, 200, and 400 ppm both in water and 20 percent oil emulsion. Tests were performed in the flush and rest growth-periods. No phytotoxicity was observed.

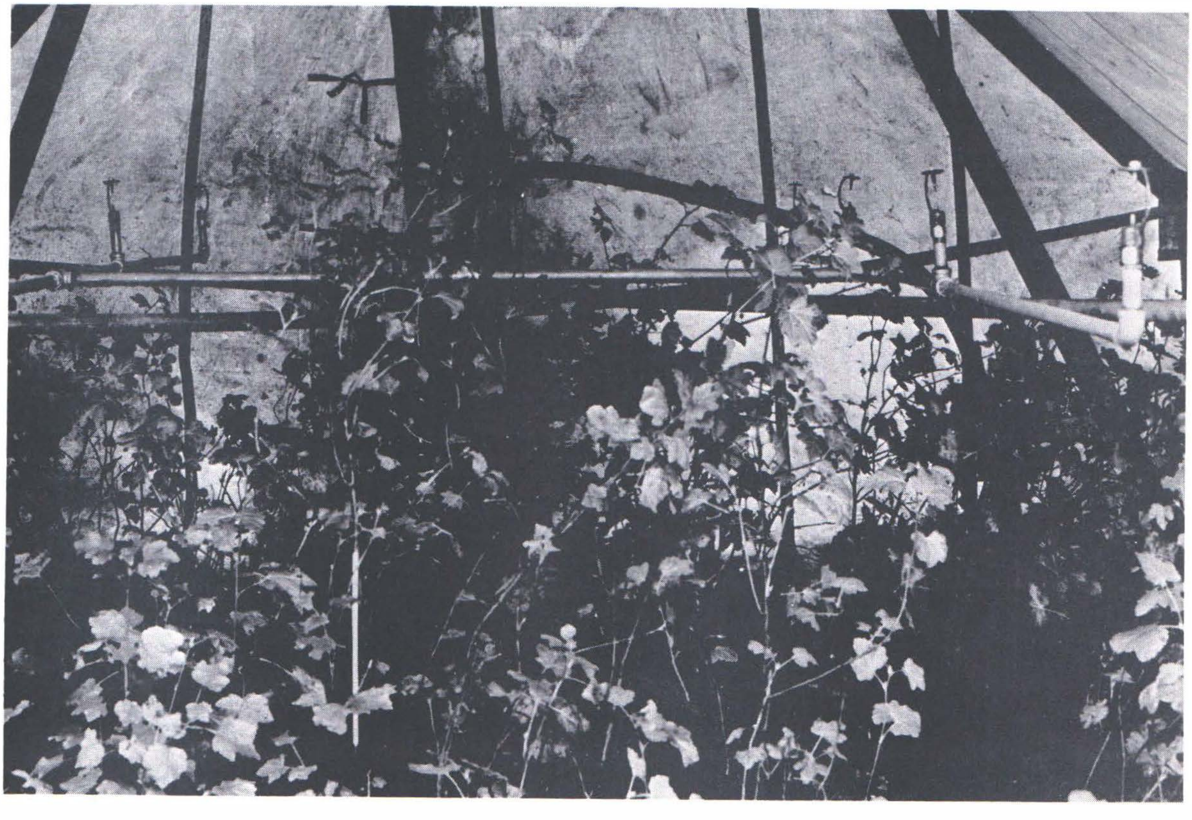
d. Seedling immunization. Two new studies in the nursery included: (1) methylhydrazone applied as a soil drench to 2-year-old potted seedlings, and (2) phytoactin slurry applied as a root dip to 3-year-old seedlings. Seedling survival in the phytoactin slurry test was low because artificial watering in the nursery was responsible for more rapid dissolution and root uptake of the antibiotic. Seedlings treated in 1960 and seedlings from previous years' treatment which had not become infected with blister rust from inoculations in 1958 and 1959 were again artificially inoculated in October 1960.

A small plantation of white pine treated with a phytoactin root-dip slurry was established in the Coeur d'Alene National Forest. Phytoactin concentration varied from 65 to 1,000 ppm. Some phytotoxicity resulted at the higher concentration ranges. Although this plantation is subjected to natural blister rust infection, a portion was artificially inoculated.

e. Artificial inoculations. Field inoculations with blister rust inoculum were performed in October on branches of the following advanced reproduction-sized trees that had been previously treated with antibiotics:



General view of inoculation tent used for artificially inoculating white pine seedlings with blister rust. Heavily infected ribes are placed among the pine seedlings.



Detail view inside inoculation tent showing arrangement of mist-type sprinkling system to maintain optimum moisture-temperature conditions for infection.

Number trees	Antibiotic	ppm	Type of treatment	Year treated	National forest
1	Acti-dione	20	foliage	1949	Coeur d'Alene
2	"	150	excise	1953	"
6	"	120	basal stem	1958	Kaniksu
6	"	150	basal stem	1959	"
6	"	150	basal stem	1960	"
6	Phytoactin	200	helicopter	1959	St. Joe
6	Semicarbazone	200	helicopter	1959	"
1	Untreated				Coeur d'Alene
6	Untreated				Kaniksu
6	Untreated				St. Joe

B. Cooperation

In Glacier National Park, Acti-dione BR and phytoactin tests by the basal stem method on whitebark, limber, and western white pines were continued. Western white pine was successfully treated on a project basis in 1960 with Acti-dione BR diluted in Montana stove oil containing the additive, Triton B-1956, to prevent antibiotic crystallization. On whitebark and limber pines, tests results by the basal stem method are encouraging, but further testing of formulations, solvents, and diluents is required to fully develop a satisfactory treatment for these two slow growing pine species.

In southern Oregon and northern California, the Umpque, Rogue, and Klamath National Forests were visited in late June by Moss to inspect and evaluate results of tests in applying Acti-dione BR and phytoactin by the basal stem method to western and sugar pines. The trip was made with Dr. William Klomparens, Head, Agricultural Research and Development, Upjohn Company, Kalamazoo, Michigan, following the inspection of antibiotic work in Region 1. In Oregon, Acti-dione BR applied by the basal stem method killed blister rust cankers on western white pine as satisfactorily as in Region 1. Results were promising on sugar pine also. Sugar pine requires a greater spray volume to visually saturate the scaly bark trunks than the smooth bark trunks of western white pine.

Upjohn Company personnel visiting the region for office and field conferences in 1960 were as follows:

Dr. David Weisblat, Technical Director
Dr. William Klomparens, Head, Agricultural Research and Development
Dr. Gerald A. Boyack, Formulation Chemist
Dr. William C. Haskett, Pathologist
Mr. Edward VandeStreek, Technical Assistant
Mr. Henry Putnam. Field Consultant
Mr. Jack Northam, Statistician
Mr. James Lipari, West Coast Sales Representative

Acti-dione BR and cycloheximide derivatives for experimental purposes were supplied by The Upjohn Company, Kalamazoo, Michigan.

Pabst Brewing Company officials visiting the region for office and field conferences in 1960 included:

Dr. Alex Sigal, Technical Director, Pabst Brewing Company
Dr. Jack Ziffer, Head, Department of Microbiology, Pabst Laboratories.

They kindly furnished phytoactin material for experimental tests in 1960.

C. Visitors

Forest Service personnel from the Washington office and scientific groups shown antibiotic work on western white pine included:

Administration: Richard E. McArdle, Chief
W. S. Swingler, Assistant Chief, State & Private Forestry
Arthur W. Greeley, Assistant Chief, National Forest Protection and Development
J. W. Farrell, Silviculture, Timber Management

Research: George M. Jemison, Deputy Assistant Chief
Thomas F. McLintock, Staff Assistant
Thomas S. Buchanan, Assistant Director, Forest Disease Research
A. A. Foster, Forest Disease Research, Macon, Georgia

Groups of visitors representing scientific organizations included:

Western International Forest Disease Work Conference
Inland Empire Section of the Society of American Foresters
Fifth World Forestry Congress members of the Rocky Mountain tour
The Northwest Pest Control Action Committee.

IV. CHAMICAL AND RIBES ECOLOGY DEVELOPMENT AND IMPROVEMENT - 1960

By
Virgil D. Moss, Research Forester

A. New Chemicals Tested for Control of Ribes, Brush and Weeds

Two soil sterilants, 22 percent Urab and 22 percent Urox, at rates of 50, 100, and 150 pounds per acre, were applied to 1/10-acre plots on a 1959 control burn in the Kaniksu National Forest. The material was applied in the flush and rest growth-periods. To determine the effect of the sterilants on established vegetation, test will be replicated next year on the same burn in the flush, rest, and dormant growth-periods. The areas are to be planted to western white pine 1, 2, and 3 years following treatment.

Purpose is to determine the feasibility of using a soil sterilant to prepare a controlled burn for planting western white pine without having to wait the customary 3 or more years after burning. To be effective, the sterilant must kill ribes species and not be toxic to white pine planted one or possibly two years after treatment. An additional desirable effect is the killing of brush and perennial grass species that hamper planting and compete with the pine seedlings.

Chemical Company representatives visiting the region for office and field conferences in 1960 were as follows:

J. R. Fisher and L. McCutchen, Agricultural Chemicals Development, Dow Chemical Company
R. J. Greenstreet, E. I. Du Pont De Nemours & Company
G. S. Batchelor, Agricultural Chemicals Technical Service, General Chemical Division
H. J. Miller and H. L. McNeill, Agricultural Chemicals, Pennsylvania Salt Company
T. Wadsley, Mora Chemical Corporation
D. Bailey, Agricultural Chemicals, Norken Corporation
C. C. Chollet, Rohm & Haas Company
C. W. Beinberg, Diamond Alkali Company

B. Status of Ribes Ecology Studies

Studies in integrating timber cutting and slash disposal practices with blister rust control were continued in cooperation with Timber Management and Fire Control staff officers on white pine forests; the Inland Empire Research Center; College of Forestry, University of Idaho; and Potlatch Forests, Incorporated.

V. MICROCLIMATE PHASES OF BLISTER RUST CONTROL - 1960

By
Merle G. Lloyd, Meteorologist
Inland Empire Research Center
Intermountain Forest and Range Experiment Station
Spokane, Washington

Climatic Requirements of Rust

Dr. Eugene P. Van Arsdel and Dr. R. V. Bega are continuing their studies of the biology and ecology of the rust in the Lake States and Pacific Southwest Stations. Temperature-humidity effects on the rust are being more closely defined through their efforts. The relationships they develop will be incorporated into the study here in the Inland Empire.

Variation of Climate over the Inland Empire

A study plan is now being prepared for an analysis of weather data from weather stations in and near the white pine belt of the Inland Empire to determine frequency of occurrence of the combination of weather factors considered necessary for white pine blister rust to maintain itself and spread. All weather data since 1948 for weather stations in the Inland Empire are now on punched cards. Agricultural Experiment Stations in each state are cooperating with the U. S. Weather Bureau to back punch data prior to 1948. Punched cards for a station are prepared as a need for analysis of the station's data develops and money is available. Most of the stations back punched in the Inland Empire are in the agricultural areas and not in or near the forest type. Costs average $10.00 a station year. There are 48 weather stations in the area with 1,824 years of data to be punched. Twenty-two of the stations have long periods of record and would be useful in the study.

Two of these long-period stations, Priest River Experimental Forest and Avery, are now being back punched to 1914. Their data will be analyzed by means of an IBM 704 as a pilot project during the spring of 1961. Based on results obtained from this analysis, the data from the remainder of the stations will be summarized.

Variation of Microclimate in Mountains

Temperature and humidity data obtained under a variety of topographic and vegetative conditions within small areas during the past five summers are being analyzed. Relationships, between climatic elements observed on sites where ribes and/or pine are found and those observed at long-period weather stations, are being developed. This will make it possible to extend chances for rust occurrence, based on weather, at long-period stations to nearby white pine sites.

Dew as a Source of Moisture for Rust Intensification

Free water on the leaves and saturated air are required for germination of the various spore stages of white pine blister rust. In the Inland Empire, summer rainfall is often deficient and certainly is erratic. Moisture may be a limiting factor for development of the rust on ribes in this area.

Dew occurs practically every night along the bottoms of moist canyons in the Inland Empire. It wets foliage an average of 9 hours per night and sometimes as long as 16 hours. From the time of earliest observation of rust in the Inland Empire, uredial intensification has been found to be heaviest along the bottoms of moist canyons. It has been attributed to heavy dew formed in these areas.

Some doubt has existed as to whether or not dew alone provides enough moisture on the lower surface of ribes leaves for germination of the spore stages of blister rust and production of sporidia. Possibly it is deposited only on the upper surfaces of the leaves and not on the lower.

To answer these questions, potted ribes were inoculated with blister rust in early June of 1960 and set out in a meadow near Benton Creek on the Priest River Experimental Forest. The plants were moved under a shelter when rain was expected. Moderate to heavy infection developed on these plants exposed only to the heavy dews which form each night on this valley bottom. By mid-July, teliospores had been produced and sporidia discharged. By the end of July most of the infected leaves had dropped and the plants were practically defoliated. A demonstration that the heavy dews which develop along the valley bottoms in the Inland Empire alone provide enough moisture to germinate the various spore stages of the rust and produce sporidia.

Air Movement in Mountainous Terrain

Study of air movement during fall moist periods favorable for spread of the rust from ribes to pine was continued in the fall of 1960. The case studies under the variety of topographic conditions encountered in the white pine belt, and particularly in areas where long distance spread is suspected, were increased. When sufficient studies have been made, it will be possible to generalize and describe areas where long distance spread may be a factor and where flexible protective widths can be established based on expected spore spread by air currents.

Weather and Aerial Spray

Favorable weather conditions are required for successful aerial spraying. Wind speed and direction and turbulent mixing of the air are weather factors influencing drift and dispersion of spray. Turbulent mixing increases as wind speed increases. It is also influenced by the vertical temperature distribution near the ground. When the wind speed reaches 7 to 8 miles per hour and/or the temperature 68° to 70° F, the air is usually found to be too bumpy for spraying. These limits have been established by experience and a study of spray operations on level ground. More study is needed on the influence of terrain on air movement and turbulent mixing during the 3 to 4 hours after daybreak when weather conditions are usually most favorable for spraying.

Water on the foliage in the form of rain or dew may influence effectiveness of the spray. Water dripping from the needles may also carry off some of the spray.

Low cloudiness and fog can reduce the favorable period for aerial operation in the hours after dawn on days otherwise favorable for spray operations. This is particularly so in spring and fall. At this time of year valley fog or stratus along ridge tops is quite frequent. The heating and mixing of the air which disperse the fog are also the factors which limit spray operations. Consequently, on some of these foggy mornings as the fog clears and/or the stratus lifts, the winds and convection which dissipate them will limit spray application.

VI. DEVELOPMENT OF RUST RESISTANT WHITE PINE - 1960

By
R. T. Bingham, Project Leader
Intermountain Forest & Range Experiment Station
Moscow, Idaho

Administrative Changes at the Northern Idaho Forest Genetics Center

The Northern Idaho Forest Genetics Center and all Region 1 personnel attached thereto were transferred to the Intermountain Forest and Range Experiment Station August 21, 1960. No changes in personnel or functions were involved; disease resistance work and financing will continue at the same level as under the Region. R. T. Bingham will continue as project leader, being directly responsible to Dr. J. W. Kimmey, Chief, Division of Forest Disease Research, Intermountain Station, Ogden, Utah.

Rust Resistant Tree Breeding Work Continues

Resistance of the better first-generation (F_1) progenies from controlled crosses among apparently resistant field selections has been gratifying, the average of the better F_1 progenies containing 30 percent seedlings which survive repeated, heavy exposures to the rust disease. Furthermore, resistance genes from certain of the wild parents are clearly "additive" in effect, allowing their accumulation toward the production of more and more resistant progenies with each successive generation of selection and breeding.

From heritability and genetic gain analyses we can predict a level of survival for F_2 progenies of near 50 percent, i.e., 20 percent greater than in F_1 materials. This level of survival under intense rust exposure will meet practical planting objectives. Since less than 10 more years of experimental crossing of selected F_1 seedlings and testing of resultant F_2 progenies will be required to verify the predicted 20 percent gain, the years 1970 to 1975 may well see large-scale establishment of seed orchards to mass-produce the resistant seed.

One hundred acres of seed orchards, ultimately providing seed for planting 10,000 acres annually, could be in partial production as early as 1985 to 1990. Depending on ability to produce and test F_2 materials, the seed from these orchards might be either (1) F_2 seed with about 50 percent survival value, produced from natural crossing among grafts from selected F_1 seedlings, or (2) F_3 seed with possibly 65-70 percent survival value, produced from natural crossing among selected F_2 seedlings.

In searching for new sources of resistance, especially for resistance to more than one physiologic race of the rust organism, we have commenced an interspecies hybridization program involving several Eurasian white pines, as follows: Armand pine, Swiss stone pine and its Siberian variety, Korean pine, Japanese white pine, Balkan pine, and Himalayan white pine. Special attention has been given to securing pollens and seed from relatively cold-resistant native stands of good growth and form. Working with cooperators in Bulgaria, Czechoslovakia, Finland, Germany, Greece, Hungary, India, Korea, Japan, and Yugoslavia, over 30 fresh pollens were received and used in the spring of 1960, in attempting to produce some 25 interspecies hybrids. Results will not be known for several years.

Work in Seed Orchard Technology

Experiments in seed orchard technology to meet the already pressing needs for information are already well underway. The Sandpoint, Idaho, Experimental Seed Orchard, a cooperative project with Region 1 and the Kaniksu National Forest, comprising some 17 acres and 1,600 grafted trees from selected rust-resistant parents, was established in the spring of 1960. Establishment followed over 3 years of grafting and site preparation work. Survival of grafted plants through fall 1960 was excellent, 92 percent. Fertilizing, mulching, and cultivation work has already commenced, the high survival attesting careful and continuing care by Kaniksu National Forest personnel.

Introduction of sterility and inhibition of pollen production by application of a "gametocide"(FW-450, a,B-dichloroisobutyrate) is being investigated as a possible means of controlling pollination within seed orchards. Exploratory tests, while inconclusive on white pine, showed that pollen from aspen catkins treated prior to pollen meiosis was ineffective, and no seed set resulted when it was used to pollinate normal female flowers.

Selection of New Rust-Resistant Trees

Selection and testing of up to 400 wild parents continues, latest test-crossing methods permitting coverage of about 50 new trees per year. At present we have found about 225 wild candidates, and about 150 of these are already tested or under test. The search will be extended into several new areas this year, notably Marble Creek on the St. Joe National Forest, and the Birch Mountain area on the Clearwater National Forest. Leads to new selection areas are welcomed.

Biochemistry of Rust Resistance

Finding the factors responsible for disease resistance in plants has been one of the most difficult problems facing biologists for many years. Blister rust resistant western white pine selections and their progeny at or near the Northern Idaho Forest Genetics Center offer unique advantages for studying the rust-resistance mechanism in this species. Research is now underway which will give much-needed information about the biochemistry of western white pine, particularly in relation to resistance and susceptibility to infection by the blister rust fungus. Needle and bark tissues from resistant and susceptible parents and progenies are being analyzed for several groups of chemical compounds. Emphasis is being placed on the sugars, amino acids, organic acids, phenols, and pigments. Dry matter content and pH of the tissues are also being studied.

VII. SCOUTING FOR WHITE PINE BLISTER RUST - 1960

By
John C. Gynn, Forester

To determine the spread of white pine blister rust, scouting for the disease was performed in the States of Montana, Wyoming, northern Colorado, northeastern Utah and southeastern Idaho.

Intensive inspections were made of pines in the general vicinity of known white pine infection centers to determine local spread and intensification. Special attention was also given to white pine in the vicinity of outlying ribes infection centers where infected ribes have been frequently found.

Tree boles and all limbs within reach from the ground and/or in good visibility were carefully examined. The upper portions of pole and mature-size trees were examined through 7 x 50 binoculars to save climbing time and obtain more tree coverage. When potential blister rust flags were seen through the binoculars on distant trees, closer observation was made for a positive identification.

Microclimate is one of the prime factors influencing the inception, intensification and spread of white pine blister rust. Mr. Merle G. Lloyd, Meteorologist, Intermountain Forest & Range Experiment Station, Inland Empire Research Center, Spokane, Washington, assisted in the scouting to study the potentiality of inception and development of blister rust in the areas inspected.

Scouting - 1960

A total of 12,230 white pines and 15,060 ribes were examined in 90 drainages on 18 national forests, 3 national parks and 2 national monuments.

The disease was found on white pine for the first time near the Rock Creek Fire Observation Point, east of Beartooth Pass on U. S. Highway 12, Custer National Forest. This does not represent a spread beyond previous known limits on white pine. However, it does represent the characteristic expansion of pine infection to stands lying between known pine infected centers. Personnel of the Salmon National Forest reported finding the rust on limber pine adjacent to the Fourth of July Creek road, Salmon National Forest. The scouting inspection readily showed fruiting cankers and flags lightly scattered throughout the white pine in this and the Blacktail Creek drainages. Rust was heavy on *Ribes petiolare* in the stream type near the confluence of the two streams. The disease was first found on white pine in this vicinity near Lost Trail Pass in 1950 and on ribes 12 miles south of Salmon, Idaho in 1949.

Although infected ribes were found in several remote locations, they did not occur in usual abundance throughout most of the Northern Rocky Mountain Region in 1960. Poor telia development and other causes prevented positive identification on some rust specimens at the time of the first laboratory testing. If further testings prove these specimens to be white pine blister rust, it will be the first time infection has been found in Colorado and/or Utah. Because of the similarity in appearance of white pine and piñon pine blister rusts (*Cronartium ribicola* and *Cronartium occidentale*) on ribes leaves, laboratory tests are made besides careful ocular examination to distinguish between the two.

Conclusions

No infection on white pine was found in 1960 that advanced known limits more than a few miles. The disease on white pine is filling in between old infection centers that form the known perimeter limits of spread. Blister rust is well established in the Bitterroot Mountain Range dividing the Beaverhead and Salmon National Forests. Because of the close association of highly susceptible pine and ribes species here, intensification and local spread can be expected to increase rapidly.

Infected ribes have been found in the same locations for several years at the known limits of spread. This indicates a high potential for white pine infection and intensification when the microclimate is favorable. It also indicates there might already be infected pines in the vicinity although none have yet been found.

White Pine Blister Rust Pine Infections Found in 1960

1. Carbon County, Montana - near Rock Creek Fire Observation Point, Custer National Forest, T. 9 S., R. 19 E., Sec. 17, probably Pinus albicaulis, origin 1947.

2. Lemhi County, Idaho - Fourth of July Creek, Salmon National Forest, T. 24 N., R. 22 E., Secs. 3, 10 and 16, probably Pinus flexilis, origin 1947 to 1951.

3. Lemhi County, Idaho - Blacktail Creek and ridge between South Fork of Sheep and Blacktail Creeks, Salmon National Forest, T. 25 N., R. 22 E., Secs. 34 and 35, Pinus flexilis and/or Pinus albicaulis, origin 1947 to 1951.

White Pine Blister Rust Infected Ribes Found in 1960

All rust on ribes definitely identified as white pine blister rust was found in former ribes infection centers or in the immediate vicinity of infected pine. Hundreds of infected ribes were noted in or very close to some of the older white pine infection centers.

Close view of a pure stand of limber pine (Pinus flexilis) in Pike National Forest near Clyde, Colorado.

A bristlecone pine (Pinus aristata) stand in Pike National Forest near Clyde, Colorado. The stand on the mountain in the distance is also bristlecone. Inspections for disease are made periodically but none has been found in this area.

Scouting Summary - 1960

Inspection location	Number drainages sampled	Number white pine examined	Number ribes examined	New pine infection	1960 ribes infection
Montana					
Lewis & Clark N.F.	5	900	550		1*
Custer N.F.	4	1,540	140	1	2*
Wyoming					
Yellowstone N.P.	6	2,000	1,900		
Grand Teton N.P.	3	300	120		
Teton N.F.	2	520	30		
Shoshone N.F.	5	2,000	2,100		1*
Medicine Bow N.F.	4	970	1,570		1*
Bridger N.F.	3	130	400		
Colorado					
Roosevelt N.F.	9	410	1,060		
Rocky Mt. N.P.	9	1,450	1,050		
Routt N.F.	3		430		?**
White River N.F.	1		240		
Utah					
Dinosaur N.M.	1		80		
Ashley N.F.	4		920		?***
Uinta N.F.	1		280		
Wasatch N.F.	5	150	1,080		
Cache N.F.	6	340	1,240		
Idaho					
Cache N.F.	1		100		
Caribou N.F.	7	480	700		
Craters of the Moon N.M.	1	500	100		
Sawtooth N.F.	6	420	760		
Challis N.F.	1		140		
Salmon N.F.	3	120	70	2	1
Total all states	90	12,230	15,060	3	6

*Rust on ribes found previously.

**Telia development not adequate for positive identification.

***Only four very small, lightly infected leaves could be found. Not sufficient for positive identification.

VIII. MECHANICAL DEVELOPMENTS FOR WHITE PINE BLISTER RUST CONTROL

By
John F. Breakey, Equipment Specialist

Aerial Spray Service Tankers

The conversion of two surplus military semitrailer fuel tankers to service tankers for mixing spray solution for antibiotic aerial spraying was the major development during the past year. Each tanker is a semisingle-axle trailer with two 1,000-gallon compartments welded into a single unit.

One mixing unit was used for the aerial spraying operation on the Coeur d'Alene National Forest. Results of this operation indicated the size, pumps, and general accessories were adequate for the intended use. Proper mixing facilities were lacking and power units were outdated. Ladders and hose racks needed improvement.

In the fall of 1960 the fuel tankers were moved to the Spokane Engineering Shops where the conversion work was done. New Wisconsin air-cooled engines were installed. Agitator shafts and mixing paddles were placed in each tank. The plumbing was rearranged so that water or spray solution can be metered into or out of either tank. Hose racks were enlarged to carry 150 feet of 2-inch hose and ladders were installed.

The conversion of these two units provides the blister rust control operations with two excellent service tankers for aerial spray operations.

Packboard Sprayers.

The Hudson 291C Booster and Dobbins 145A compressed air sprayers, fastened to military-type molded plywood packboards with galvanized iron straps, proved to be the best unit for hand spraying operations. Variations in length of life and performance of the parts of the sprayers caused some delays in the spraying operations. Some of the discharge accessories on both makes of sprayers required replacing. The spray wands furnished by the companies were found to be too light. Replacements were made with 1/8-inch pipe or heavy 3/8-inch brass tube. The Hudson multi-spray nozzle No. 4195-502 mounted on the heavy spray wands is recommended.

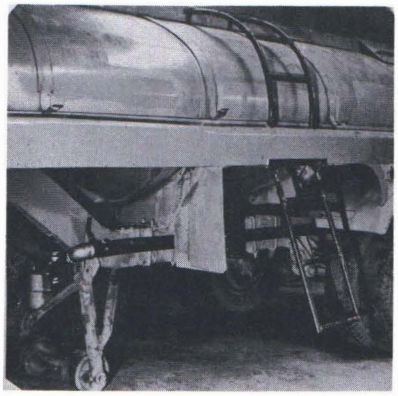
Hudson's No. 4940 Roto-Valve, sold as a part of their booster sprayer, is not suitable for control of oil sprays. Special trials were made with Hudson's No. R-752 packing seal. These tests showed this unit to be very satisfactory. These converted valves have not been used by field crews.

General Field Tools

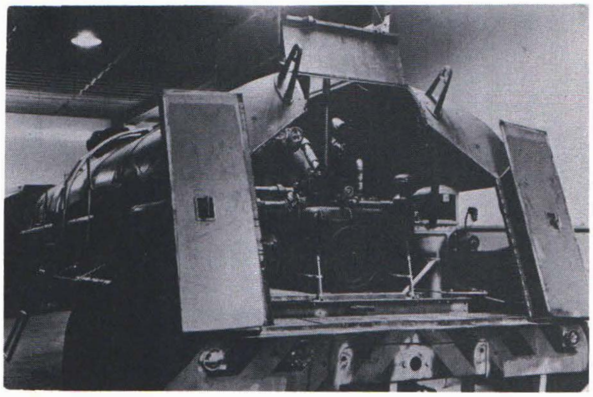
A pillow-shaped treated fabric liquid container, manufactured experimentally by Fire Equipment Development Co., San Leandro, California, was tested for rate of filling and ease of handling. The company promises to have an oil-proof one by mid-1961. Bucket-shaped small samples were made in the Spokane Warehouse canvas shop. None held oil more than 8 hours.

The Packboard Rigid Frame Carrier is recommended as a tool suited for packing heavy loads.

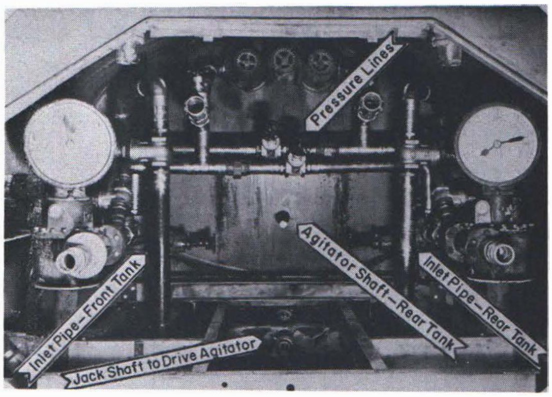
AERIAL SPRAY SERVICE TANKER



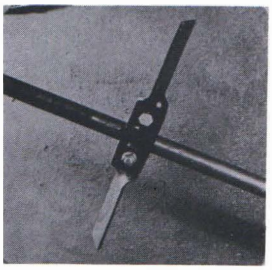
SERVICE LADDER and
INTAKE LINE to FRONT TANK



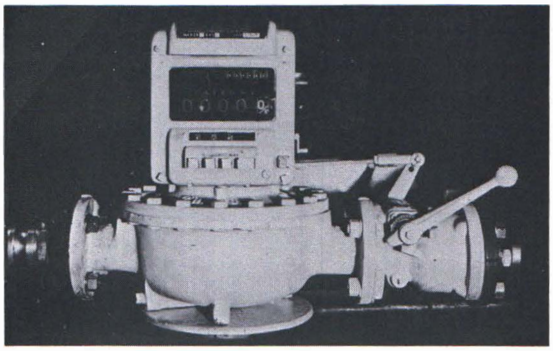
TANKER COMPLETE SHOWING
UPPER REAR CANOPY DOOR


Pressure Lines
Inlet Pipe—Front Tank
Jack Shaft to Drive Agitator
Agitator Shaft—Rear Tank
Inlet Pipe—Rear Tank

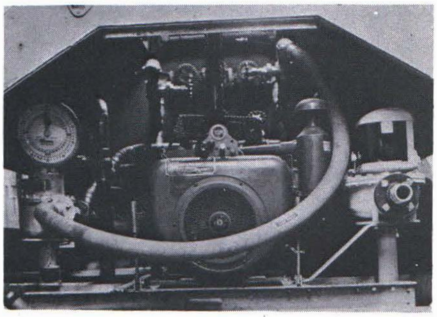
PIPING INTERCHANGE
to PUMPS and METERS



LEFT and RIGHT AGITATOR
PADDLE and SHAFT



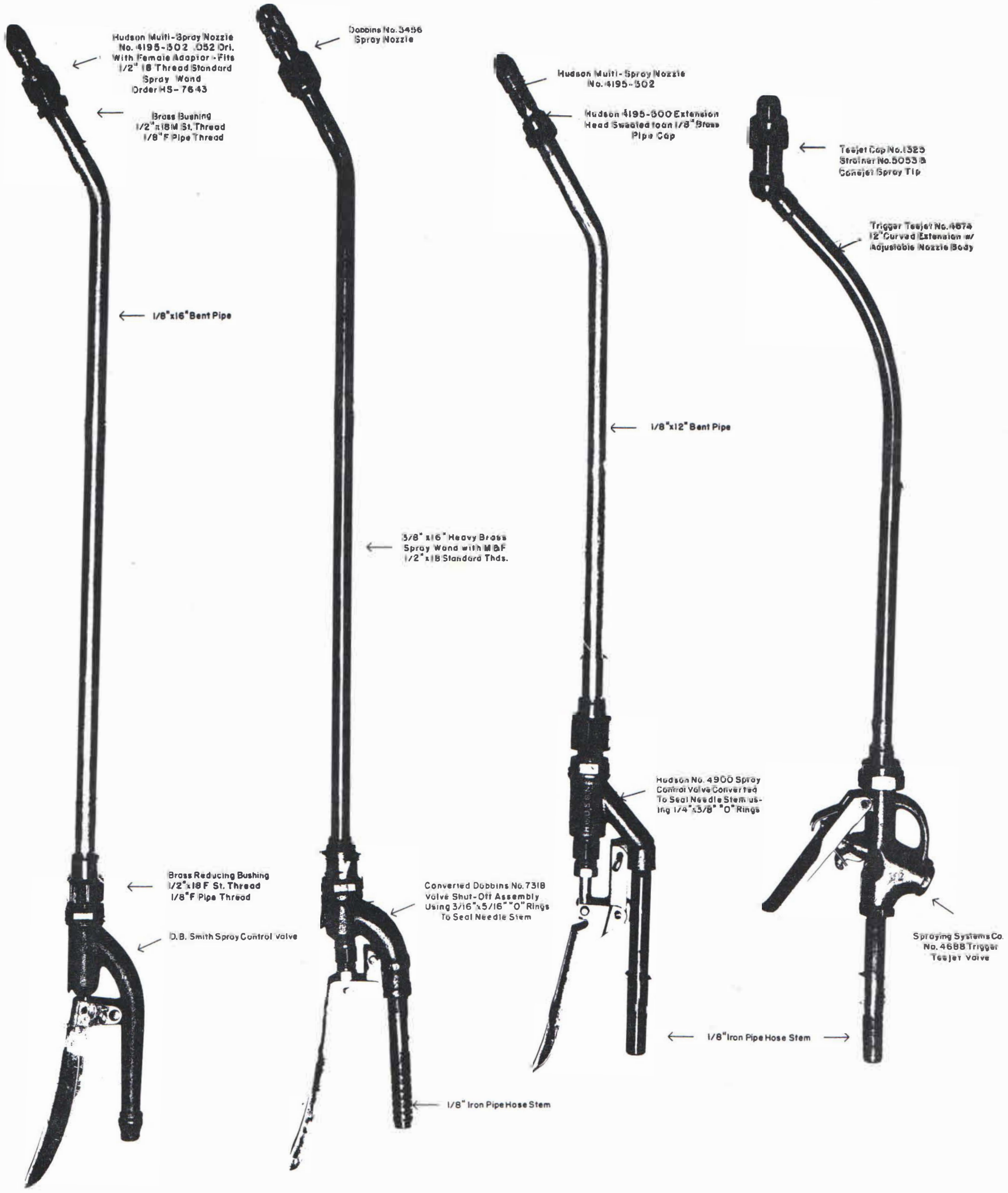
AUTOMATIC REPEAT
BATCH METER



METERING WATER
to REAR TANK

SPRAYER DISCHARGE PARTS

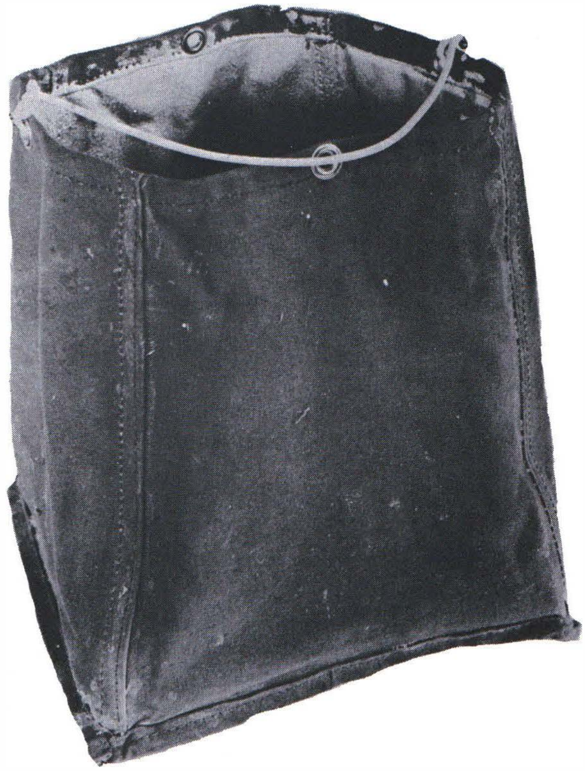
Wands, Trigger Control Valves, and Nozzles


Hudson Multi-Spray Nozzle No. 4195-502 .052 Ori. With Female Adaptor - Fits 1/2" 18 Thread Standard Spray Wand Order HS-7643
Brass Bushing 1/2"x18M St. Thread 1/8"F Pipe Thread
1/8"x16" Bent Pipe
Brass Reducing Bushing 1/2"x18 F St. Thread 1/8"F Pipe Thread
D.B. Smith Spray Control valve
Dobbins No. 3456 Spray Nozzle
3/8" x16" Heavy Brass Spray Wand with M&F 1/2"x18 Standard Thds.
Converted Dobbins No. 7318 Valve Shut-Off Assembly Using 3/16"x5/16" "O" Rings To Seal Needle Stem
1/8" Iron Pipe Hose Stem
Hudson Multi-Spray Nozzle No. 4195-502
Hudson 4195-500 Extension Head Sweated to an 1/8" Brass Pipe Cap
1/8"x12" Bent Pipe
Hudson No. 4900 Spray Control Valve Converted To Seal Needle Stem using 1/4"x3/8" "O" Rings
1/8" Iron Pipe Hose Stem
Teejet Cap No. 1325 Strainer No. 5053 B Conejet Spray Tip
Trigger Teejet No. 4674 12" Curved Extension w/ Adjustable Nozzle Body
Spraying Systems Co. No. 4688 Trigger Teejet Valve

GENERAL FIELD TOOLS

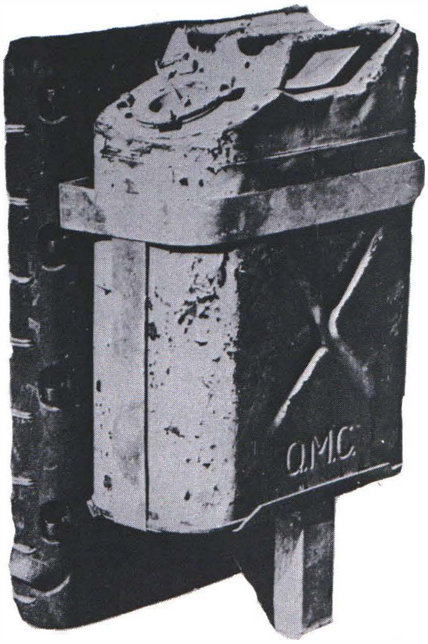
STOVE OIL CONTAINER

Experimental Folding Type



RIGID FRAME CARRIER

for Jeep Cans and Field Radios



IX. APPENDIX

Guidelines for Region 1 Blister Rust Control Program.

The following is the objective and guidelines for Region 1 blister rust control program as written in the Forest Service Manual 3480.1, 3480.3, 5270.1 and 5272.01, R-1 Supplements No. 62 and 63.

The objective of the blister rust control program in Region 1, regardless of ownership, is to protect all western white pine stands within approved white pine management units through ribes eradication and/or application of antibiotics; and without ribes eradication to save as much western white pine as possible on additional areas by application of antibiotics.

The following guidelines shall be followed in planning Region 1 blister rust control programs:

1. On all approved white pine management units supporting western white pine stands over 20 years of age, antibiotic treatment has preference over ribes eradication.

2. Ribes eradication will be confined to approved white pine management units on:

    a. Areas prepared for planting to western white pine.

    b. Areas planned for natural regeneration of western white pine.

    c. Stands under 20 years of age.

    d. Stream-type areas.

    e. High rust-hazard areas.

3. Additional white pine stands brought into the control program by virtue of antibiotics must be of such a nature that they can be carried through to commercial maturity by application of antibiotics without ribes eradication other than occasional stream-type ribes. At this time we are concerned only with the present crop on these additional areas. The next crop will depend on developments in rust resistant pine and antibiotics plus economic changes.

4. Highly accessible areas supporting reproduction and young pole stands have top priority for hand treatment with antibiotics.

5. Inaccessible stands of western white pine should be deferred and scheduled for possible aerial spraying.

6. Other factors being equal, present program units have highest treatment priority.

7. In determining priority of stands for antibiotic treatment, regardless of method of application, take into consideration the following factors:

   a. Actual stand value (final yield per acre).

   b. Estimated number of treatments required to bring stand to merchantable size (cost per M).

   c. How long can initial treatment be delayed.

8. The stand age-classes in short supply on each working circle and for the region should be given due consideration.

9. Give due consideration to recreational areas and administrative sites when western white pine has esthetic value. Special consideration should be given to all western white pine demonstration and research areas.

10. The long-term objective is to treat with antibiotics all potentially commercial stands of western white pine in the Inland Empire if and when treatment is needed. In general, this should be accomplished by 1970.

11. We must determine the size of the job, time available to do the job, and funds required.

12. Each blister rust control operation should have, by the end of 1960, a complete inventory of all potentially commercial western white pine stands on national forest and state and private lands that could be treated with antibiotics. This extensive survey is for all ownerships, both inside and outside presently approved white pine management units.

13. Areas recommended for current-year treatment will need intensive surveys for determining priority of work.

14. All antibiotic control work must be closely correlated with all other land management activities. The land manager must be kept informed at all times.

15. Reproduction and pole stands in present state and private program units should be treated with antibiotics, if needed, before antibiotic treatment is expanded to state and private lands outside the present program.

16. In planning the state and private antibiotic long-term program a reasonable effort must be made to see that each paying member of the associations receives benefits in direct proportion to his contribution. This should average out regionwise.

17. Antibiotic treatment of state and privately owned stands must be financed from cooperative and federal matching funds.

18. Encourage small woodlot owners to treat their western white pine stands with antibiotics if needed.

19. Within limitations, collect K-V funds for treating western white pine stands on sale areas within approved white pine management units and on pole stands in sale areas outside of white pine units when approved by the Divisions of Timber Management and State & Private Forestry.

ANTIBIOTICS LOOK GOOD IN THE FIGHT TO SAVE WESTERN WHITE PINE FROM BLISTER RUST

As complete research reports on the discovery, development and systemic action of antibiotics for the control of white pine blister rust on western white pine have been or soon will be published, this paper deals mainly with the practical field application and the potential of antibiotics in this field.

Rust Development

White pine blister rust became established in the western white pine belt of northern Idaho and contiguous portions of eastern Washington and western Montana in 1923. With optimum conditions for introduction and intensification, the rust spread quickly throughout the 3,600,000 acres of western white pine type. Control of the disease through eradication of the alternate host (Ribes) proved to be both difficult and costly. High rust-hazard areas could not be protected within reasonable costs. Due to the curtailment of control funds during and following World War II, it was necessary to reduce the western white pine protection area from 2¼ million acres to one million acres. By 1948, it was evident that most of the unprotected immature western white pine stands would be lost to the rust and some unprotected mature white pine stands would be severely damaged before they could be harvested. Considerable damaging blister rust infection was occurring within protection areas where microclimate was favorable for the development and spread of the rust, and where ribes had not been suppressed to the required standards. A systemic antifungal antibiotic was needed to control this billion dollar menace to western white pine - the fastest growing conifer in the Inland Empire.

Proven Antibiotics

Among the 66 chemicals and compounds subjected to screening tests by Virgil D. Moss[1], two were found to successfully kill blister rust infections on western white pine. These were the antibiotics cycloheximide (which is sold under the trademark of Acti-dione BR) and phytoactin. Both are derived from species of Streptomyces. Cycloheximide showed considerable promise by 1953 and phytoactin showed promise in late 1958. As cycloheximide was a more fully tested and proven fungicide, it is the only antibiotic that has been applied by field crews on a project basis. Phytoactin is being fully field tested and developed and may soon be on equal footing with cycloheximide.

Basal Stem Application of Cycloheximide

The basal stem application is an effective method for year-round treatment of immature western white pine for all canker stages of blister rust at and above the treated trunk area.

By H. J. Hartman, Head, Section of Forest Insect and Disease Prevention and Control, U. S. Forest Service, Missoula, Montana. Presented to Annual Meeting of Society of American Foresters, Washington, D.C., November 16, 1960.

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[1] Research Forester, Division of State & Private Forestry, Blister Rust Control, Region 1, U. S. Forest Service.

The standard solution is 4 percent cycloheximide diluted to 150 parts per million with No. 1 fuel (stove) oil. Trees up to 12 feet in height, the lower one-third of the trunks, are sprayed with the mixture. Trunks of trees over 12 feet high are sprayed up to 5 feet. The inner 18 inches of the branches growing from the treated trunk area are also sprayed. Application of spray mixture is just to the point of run-off.

When applied by the basal stem method cycloheximide is absorbed by, persists in, and is translocated upward in western white pine. All potentially damaging infection is killed within 2 years on trees 50 feet in height regardless of the location of the infection in the tree. All evidence indicates that the same results can be attained on mature western white pines.

While cycloheximide persists for at least 2 years in the bark at the site of application, the exact period of blister rust infection immunity that will result from a single application is not known. Western white pine trees treated with cycloheximide have to date not become reinfected. It is estimated that on medium and low rust-hazard areas without any immunity a 40-year-old pole stand may require 2 to 3 treatments before reaching 100 years of age. Following the antibiotic application it is expected that the treated stand will become reinfected with blister rust. When this reinfection develops to the damaging stage, re-treatment will be required. How often re-treatment is required will depend mainly on the size of the trees and the rust-hazard of the particular locality. Most immature stands of western white pine in the northwest occurring on high rust-hazard areas, where no ribes eradication was performed, have already been lost to the rust. Thus, remaining salvable stands are mainly limited to medium and low rust-hazard areas.

Cycloheximide may be applied any month of the year with highly effective results providing trunk surface is not frozen and application is made when it is not raining. Results are in direct proportion to thoroughness of application.

When white pine stands are more than lightly infected, it has proved less costly to treat all the desired stocking in the stand than to look for and treat only rust infected trees. To retain full stocking in many infected stands immediate treatment is required.

Under average working conditions 8 hours is required to treat 2 acres of pole-size timber by the basal stem method. Some 600 to 700 saplings can be treated in 8 hours, requiring 8 to 10 gallons of spray solution. The average cost of spray solution per tree is approximately 3¢.

Trees selected for treatment should be of good color and growth, with not more than two-thirds of the trunk circumference already girdled by the fungus. Canker wounds on vigorous trees generally heal before attack by harmful insects and wood-rotting fungi. If an infected trunk or branch has been nearly girdled by the fungus, the application of cycloheximide hastens the death of that portion of the tree beyond or above the canker.

Cycloheximide can be applied with any mist-type sprayer. However, a 3- to 4-gallon capacity compressed air sprayer mounted on a pack-board is best when several acres of white pine are to be treated. The most efficient and effective nozzle-cap orifice is .040 to .052 inch.

No harmful side effects from the antibiotic has resulted in treating over 10 million western white pines by the basal stem method. However, trees under 15 years of age can be injured by the cycloheximide stove oil solution unless instructions for applying cycloheximide solution are explicitly followed.

Foliar Spraying by Helicopter

Both phytoactin and semicarbazone (a derivative of cycloheximide) have been successfully applied by helicopter to western white pine pole stands. When these antibiotics were applied at the rate of 10 gallons per acre in a 200 ppm solution, all blister rust infection was killed on about 80 percent of the trees.

Phytoactin was applied in a water solution and semicarbazone in a 20 percent oil emulsion. As the semicarbazone solution was phytotoxic, all 2- and 3-year-old needles were cast on western white pine. Other associated tree species were not affected. Phytoactin showed no phytotoxic action.

Under favorable working conditions a G-2 helicopter will apply 250 gallons of spray solution per hour. The helicopter cost was $4.00 per acre when applying antibiotics at the rate of 10 gallons per acre. It is estimated that $13.00 per acre will be the overall cost of applying antibiotics by helicopter for blister rust control under average conditions.

Both phytoactin and semicarbazone have been applied to white pine pole stands by fixed-wing plane. The results of this blister rust control test will be known in 1961.

Immunization of Nursery-grown Seedlings

Antibiotics introduced by root absorption are being tested to immunize nursery-grown seedlings from blister rust infection to permit the early outplanting of controlled burns before ribes seed germination is complete and areas become sodded and brushed over.

Although all present cycloheximide derivatives proved too toxic on western white pine in this type of treatment, the present tests indicated it is possible to immunize seedlings against blister rust infection with antibiotics. Results of phytoactin tests show good promise.

Crystallization of Cyclcheximide in No. 1 Fuel (stove) Oil Solution

Many No. 1 fuel oils do not hold cycloheximide in solution long enough for fully effective application. If the fuel oil being used is not compatible with cycloheximide, crystallization of the antibiotic starts in a matter of 20 minutes or more. This crystallization places the cycloheximide in an unusable form and greatly reduces or destroys its effectiveness. When the concentration of cycloheximide is increased in a spray solution the rate of crystallization also increases. It appears that for proper biological action the cycloheximide should remain in solution for at least several days.

Any fuel oil being used as a carrier for cycloheximide should be tested for crystallization. Once cycloheximide crystals are formed they cannot be placed back in solution through agitation.

This crystallization problem may be corrected by adding an oil soluble surfactant when the spray solution is being prepared. The surfactant Triton B-1956 appears to give good results. As an additional precaution the spray solution should be prepared on a day-to-day basis.

The presence of water in fuel oil and mixing containers extracts cycloheximide from the oil. All fuel oil used for basal stem treatment should be made as free of water as is possible.

The use of incompatible fuel oil as a carrier for cycloheximide can cause cycloheximide field tests to be failures.

Control Method Changes

The antibiotic developments mentioned have greatly revolutionized former western white pine blister rust control methods and control area concept.

The long-term objective now is to treat with antibiotics all potentially commercial stands of western white pine over 15 years of age in the region, if and when treatment is needed. Aircraft will be widely used in the application of antibiotics. In general, this initial treatment should be accomplished by 1970.

Approximately 85 percent of the one million acres in the present blister rust protection area will be brought on through to commercial maturity with antibiotics and without additional ribes eradication.

An additional one million acres of white pine area will be brought back into the control program. These added stands will be of such a nature that they can be brought through to commercial maturity by application of antibiotics and without ribes eradication. Of concern at this time is only the present crop on these added areas. The second crop will depend much upon development of rust resistant pine by the Northern Idaho Forest Genetics Center and antibiotics plus economic changes.

Until the full potential of antibiotics are known and field-tested, ribes eradication will be continued only on areas being prepared for planting to western white pine and on areas planned for natural western white pine regeneration.

Cycloheximide has been applied by the basal stem method to western white pine stands on national forests, national parks and on state and private lands. In 1960, 75 percent of the blister rust control field crew of 900 men was employed in the application of cycloheximide.

Effective formulations and application techniques have not yet been fully developed for killing blister rust infection on limber and whitebark pines.

If antibiotic aerial spraying of mature stands proves effective, one billion board feet of lethally infected 120- to 140-year-old western white pine may be treated. This will permit an orderly harvesting of these presently inaccessible stands plus years of additional increment.

There are wide ecological and pathological differences between white pine producing regions of the nation. The western white pine region appears to be the best suited and in greatest need of wide-scale application of antibiotics for control of white pine blister rust.

The discovery and development of systemic antibiotics for trees ushers in a new era of disease control in forestry - an era of promise and hard work.